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Fleet Battle Experiment Juliet Final Reconstruction and Analysis Report

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NAVAL POSTGRADUATE SCHOOL
Monterey, California

Fleet Battle Experiment Juliet
Final Reconstruction and Analysis Report

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Table of Contents

Appendices

Section I: Experiment Description

1.0 Introduction

This Section provides a high-level overview of the entire experiment to acquaint the reader with the general background, context, and objectives for each of the initiatives. Background on categorization, data collection, and analysis methodologies is also presented.

1.1 Fleet Battle Experiments Purpose and History

Historically, Fleet Battle Experiments (FBEs) have existed in order to streamline and invigorate warfare doctrine refinement, and to bring innovation to the processes of developing and prosecuting warfare concepts. They have been designed to speed the delivery of innovation and advanced warfare capabilities to the fleet by identifying concept-based requirements and evaluating the merit of new operational capabilities.

More recently, in an effort to improve the overall, integrated capabilities of U.S. forces, an over-arching set of experiments called Millennium Challenge (MC) was instituted. The MC experiments are sponsored and implemented by U.S. Joint Forces Command and are operated at the same time as, and in the conjunction with, service experiments. MC-00, the first of the MC series, was carried out at the same time as FBE-H. FBE-J was carried out with MC-02. This combination of over-arching joint and service experiments provided a common venue for the service experiments, and leveraged them into examinations and improvements in joint warfighting capabilities.

A significant focus of both MC and FBE experiments has been the use of information to support warfare areas. The primary goal is to enable commanders to make fast, accurate decisions in battle. The range of information-related objectives has been broad, including content, accuracy, timeliness, dissemination, distribution, display, and also the processes by which the information is used for decision making.

The experiments involve live forces but make extensive use of simulations to minimize the expense of employing operational resources. Simulation is especially valuable as a means to insert opposing forces into an operation. Simulation also permits playing some future systems, primarily weapons and sensors, by introducing their performance into the simulation.

The experiments improve awareness about the most pressing operational challenges of the future and have led to recommendations for changes in doctrine, organization, training, material, leadership, personnel, or facilities (DOTMLPF). They examine how a robust, common information environment coupled with collaborative tools, increases shared battlespace awareness and simultaneous planning necessary to achieve decision superiority. Weaknesses in today’s crisis action planning processes and battlespace executions are identified, quantified, and appropriate resolutions are recommended.

There have been ten FBEs conducted since 1997:

Experiment	Timeframe	Principal Warfare Areas or Concepts
FBE-Alpha	Apr -May 1997	MAGTAF
FBE-Bravo	Aug-Sep 1997	Fires
FBE-Charlie	Apr-May 1998	Ring-of Fire; AADC
FBE-Delta	Oct-Nov 1998	Land Attack from Sea
FBE-Echo	Mar 1999	Asymmetric Threats
FBE-Foxtrot	Nov-Dec 1999	Joint Maritime Access
FBE-Golf	Apr 2000	Theater Air Missile Defense
FBE-Hotel	Aug-Sep 2000	Flexible Command and Control
FBE-India	May -June 2001	Forced Entry and Access for Contingencies
FBE-Juliet	July-Aug 2002	Assured Access; Maritime Command and Control

FBE Alpha used the U. S. Marine Corps' Hunter Warrior scenario, and was designed to test the ability of a sea-based Special Marine Air-Ground Task Force to conduct dispersed operations on a distributed, non-contiguous battlefield.

FBE Bravo was designed to leverage the lessons and observations from FBE Alpha with a focus on the Joint Vision 2010 Precision Engagement operational concept, and precision fires in a littoral Joint Operating Area. FBE Bravo was hosted by Commander Third Fleet and conducted in the southern California operating area.

FBE Charlie examined an area air defense commander (AADC) separated geographically from the Joint Forces Air Combat Coordinator using a prototype AADC system to plan and execute an air defense plan for theater air and missile defense. FBE Charlie also explored a warfare concept called Ring of Fire, using integrated deconfliction tools, sophisticated target prioritization, close air support, improved weapon-target pairing, and automated checks for protected or prohibited targets. Commander Second Fleet hosted FBE Charlie.

FBE Delta, conducted during Exercise Foal Eagle '98, an annual joint and combined exercise sponsored by Combined Forces Command Korea, was the first forward deployed joint and combined experiment. FBE Delta examined a land-sea engagement network, which linked 22 Land Attack Weapons System stations at sea to 80 automated deep operations coordination systems ashore. Commander Seventh Fleet hosted FBE Delta.

FBE Echo was conducted concurrently with the U. S. Marine Corps experiment Urban Warrior. Operations focused on humanitarian assistance, asymmetric threats, precision engagement, littoral air and missile defense, disaster relief, undersea warfare, information assurance and casualty management. FBE Echo was hosted by Commander Third Fleet and conducted in the San Francisco and Monterey Bay areas.

FBE Foxtrot was built around the U. S. Central Command's operational need to assure Joint Maritime Access to the Arabian Gulf. The experiment included concurrent Anti-Submarine Warfare and Mine Countermeasures, with simultaneous operations by a Joint Fires Element against air, coastal missile, artillery, and asymmetric attacks. FBE Foxtrot was hosted by Commander Fifth Fleet and conducted in the Arabian Gulf.

FBE Golf focused on Time Critical Targeting (TCT) and examined joint and combined theater air missile defense (J/CTAMD) with NATO participation and information management. FBE Golf was hosted by Commander Sixth Fleet and conducted in the Mediterranean Sea.

FBE Hotel was conducted in conjunction with the U.S. Joint Forces Command Millennium Challenge experiment, MC-00, the Army's Joint Contingency Force Advanced Warfighting Experiment, the Air Force's Joint Expeditionary Force experiment (JEFX-00) and the Marine Corps' Millennium Dragon experiment, making it the first all-service experiment. FBE Hotel focused on flexible command and control processes, at the component level, using a Joint Force Maritime Component Commander (JFMCC) structure. FBE Hotel was hosted by Commander Second Fleet and conducted in the Gulf of Mexico and southern U.S.

FBE India was conducted in conjunction with the U.S. Marine Corps Capable Warrior (CW) and extending the Littoral Battlespace (ELB) initiatives focusing on forced entry and access for expeditionary contingency operations. FBE India initiatives included information management and integration, battle space preparation, real time sensor management, time critical targeting (TCT), medical casualty and non-governmental organization management, virtual collaborative planning and experimental command and control (C2) architecture. FBE India was hosted by Commander Third Fleet and conducted in the Southern California area.

1.2 FBE-Juliet: General Description

The two major experimentation areas for FBE-J were:

(1) Sea-based Joint and Maritime Command and Control
(2) Assured Access

Sea-based joint command and control was an opportunity presented by Commander Joint Task Force (CJTF) and Joint Special Operations Task Force (JSOTF) plans to base portions of their staffs afloat on the Fleet Command Ship. FBE-J examined C4ISR information and support needs to fully enable joint command from a Fleet Command Ship.

For assured access, the scenario presented concurrent threats by submarines, mines, coastal cruise missiles, and enemy land and air assets. The joint environment and warfighting scenario presented an opportunity to experiment with Maritime Command and Control across almost all maritime warfare areas in a difficult littoral environment.

As noted above, FBE-J was conducted in conjunction with MC02. The experiments were conducted from 24 July to 15 August 2002 in the US western sea and land ranges. The Congressional mandate for MC02 included direction to integrate service and joint experimentation. MC02 was conducted primarily at the strategic and operational levels while FBE-J was at the operational and tactical levels, with coordination occurring at the operational level. Separate simulations were utilized for the two experiments, necessitating passing information between them to coordinate tactical actions and joint-level decisions.

The timeframe for the experiment setting was 2007. This limited experimentation to those capabilities resident in the future years defense program (FYDP) in 2002 that are reasonably achievable by 2007.

MC02 was essentially a command post exercise. The JTFC staff passed directives to the service components where execution was accomplished. J9 operated a Red Cell that initiated OPFOR actions. The J9 simulation passed actions to service simulations, with situational awareness provided by GCCS. A White Cell provided adjudication, when needed. A high degree of coordination was needed between the various simulations if the play were to be realistic.

FBE-J was a mix of live and simulated activities in order to examine operational and tactical warfighting issues in a real environment. There were periods during the experiment when FBE-J operated independent of the joint environment. At such times, Navy simulation provided Red-Force activities. At the service level, simulation is used to examine systems that do not yet exist, to fill out orders of battle, and to determine effects due to force numbers.

FBE-J was much more tightly integrated into a joint warfighting context than prior efforts. This involved a greatly increased level of effort, a need for subject matter expertise not resident at NWDC, and much greater expense. The advantage was an experimental venue that was completely joint. This provided greater validity to Navy operational level experimentation and greater validity for acquisition-based lessons learned.

FBE-J was an attempt to experiment in almost every maritime warfare area. The scenario supported experimentation in strike, anti-submarine warfare, mine warfare, anti-surface warfare, information operations, and intelligence, surveillance, and reconnaissance.

This FBE was preceded by a series of Limited Objective Experiments (LOEs) for high-speed vessel and mine warfare. These iterative experimentation processes used the FBE as the largest venue in a series of experiments.

The FBE-J/MC02 pair involved concurrent and mutually reinforcing joint doctrine development and joint/service experimentation. A coherent series of seminars, organizational process model development, organizational workflow depictions, and workshops were developed into a new paradigm for doctrine development. The experiment also provided a live, joint environment for field-testing proposed Joint Maritime Component Commander doctrine.

Overview of Activities in FBE-J

FBE-J Activities in Joint and Maritime Command and Control

- Maritime Operational Planning Process
    - Objective: Field-test the draft joint doctrine for JFMCC.
    - Action: Refine the roles, functions, and planning process for the Joint Force Maritime Component Commander.

- Sea-Based Joint Command and Control (C2)
    - Objective: Lessons learned for doctrine, organization, training, manning, and technology in support of ship-based joint command and control.
    - Action: Refine C4ISR and support for a sea-based Joint Force Commander.

- Netted Force (NF)
    - Objective: Provide lessons learned for development of expeditionary networks.
    - Actions: Develop innovative solutions to the seams between forward based forces and rear echelon forces through exploration of innovative networking. Additionally, improve coalition information exchange using software agent-based systems.

- FBE-J Naval Fires Network (NFN (X))
    - Objective: Provide field-tested NFN TACMEMO for Fleet use. Provide lessons learned for NFN converged architecture development. Provide lessons learned for joint doctrine, organizations, training, and manning when joint intelligence, surveillance, and reconnaissance (ISR) assets can be shared and distributed across the CJTF.

- Actions: Assess Naval Fires Network (Experimental) (NFN (X)) system and develop TTP and CONOPS to support sea-based fires in a joint environment. Explore innovative linkage of NFN (X) to the joint fires network. Provide field-tested results for bandwidth, weapon-target pairing, and deconfliction.

FBE-J Activities in Assured Access

- Unmanned Sensors and Platforms
  - Objective: Provide CONOPS leading to TACMEMOs for airspace, waterspace, and sea-surface management; deconfliction; and asset optimization in a highly mixed manned and unmanned environment. Provide lessons learned for doctrine, organizations, training, and manning based on use of manned and unmanned sensors and platforms.
  - Actions: Refine the concepts of employment for distributed, networked, manned and unmanned platforms, and remote sensors, for anti-submarine warfare (ASW)/anti surface warfare (ASUW) / Mine Warfare (MIW).

- Theater Air and Missile Defense
  - Objective: Provide field-tested CONOPS leading to TACMEMO for Navy lower tier, Navy theater-wide, and Navy Area Air Defense Commander Module systems in a joint environment. Provide lessons learned for doctrine and organizations in use of these emerging systems.
  - Action: Examine multi-mission pull and joint C2 of Navy TBMD capable units.

- Anti-Submarine Warfare (ASW)
  - Objective: Provide field-tested CONOPS and technological recommendations to mitigate seams between local and theater ASW efforts.
  - Action: Examine coordination from theater ASW commander to local ASW Commander, in integrating unmanned sensors and platforms with manned sensors and platforms.

- Anti- Surface Warfare (ASUW)
  - Objective: Provide field-tested CONOPS leading to TACMEMO development or fleet use of joint and Navy assets versus the swarming small boat threat.
  - Action: Examine joint tactical packages to counter swarming small boat threat.

- Mine Warfare (MIW)
  - Objective: Provide field tested CONOPS leading to TACMEMO development for fleet use of emerging mine warfare systems
  - Action: Refine concepts of employment for organic and dedicated MIW forces in assured access mission

- Information Operations (IO)
  - Objective: Determine if IO forward and JFMCC IO staff contribution were incorporated in the Maritime Planning Process and were sufficient/insufficient to produce the products, information, guidance, or feedback necessary to construct an MTO. Where insufficient, determine contributors to lack of process, products, information, collaboration, or control.
  - Action: Integrate kinetic and non-kinetic engagement options to develop computer network defense CONOPS. Evaluate the impact of cross-component engagement network and supporting TTP.

MC-02 Activities Proposed by NWDC

- Joint Fires
    - Objective: Provide recommendations for acquisition of system enabling coordination of joint Fires across the CJTF.
    - Action: Evaluate the impact of cross-component engagement network and supporting TTP.

- High Speed Vessel (HSV)
    - Objective: Provide lessons learned for development of future Navy combatants and support vessels to include littoral support craft, logistics, and vessels.
    - Action: Evaluate vessel speed, size, range, and endurance along with reconfigurable payload characteristics for assured access missions. Explore use of HSV for transport, USW, fire support, sensor support, medical support, and sea-based C2.

2.0 Initiative Descriptions

Following are brief overviews of the individual initiatives. They provide an overall description of the background for each initiative; a statement relating the initiative to the warfighting challenge in approximately five years; a brief characterization of the initiative itself; and then one or more questions, which provide the foci for the subsequent analyses.

2.1 Joint Forces Maritime Component Commander (JFMCC) Maritime Planning Process (MPP)

Description: The JFMCC process is a collective interaction among a number of processes that interpret guidance from the JFC, produce a Joint Maritime Operations Plan (JMOP), define Maritime Support Requests (MARSUPREQs), prioritize actions in a Maritime Master Attack Plan (MMAP), and assign actions to individual maritime commanders in a Maritime Tasking Order (MTO).

Relationship to warfighting challenge in 2007: In the 2007 timeframe, there will be multi-functional maritime platforms with multiple weapons systems, sensors, organic capabilities, highly sophisticated C2 systems, and low manning. Providing access to the littorals will be a requirement for maritime forces, often ahead of Time Phased Force Deployment and Joint capabilities. A Maritime Tasking Order will be required to optimize, synchronize, and interrelate forces that are both maritime and joint. The principal warfighting areas included in this initiative, as produced within the context of the experiment scenario are:

- Production of a Maritime Tasking Order through a Maritime Planning Process.
- Collaboration with Joint and Principal Warfare Commanders.
- Support for, and feedback to, a jointly constructed Effects Tasking Order (ETO).
- Tracking and redefinition of MTO events as they are executed.
- Definition of requirements for manning, tools, and C2.

Initiative Definition: The JFMCC process was analyzed to determine the overall efficiency and effectiveness in generating an MTO. The analysis was structured to decompose complex processes into their component sub-processes, and then assess their relative merit and contributions to the commander's understanding of the operational situation. Processes that were overly complex or time consuming were to be identified.

Overarching Question: Did the JFMCC Maritime Planning Process add structure, organization, management, feedback, optimization, and situational awareness to maritime force employment, and did it support the intent of a jointly developed Effects Tasking Order (ETO)?

2.2 Joint Fires Initiative (JFI)

Description: This was the application of common tools, processes, CONOPS, and architecture to conduct joint integrated Fires, which deconflicted Fires in space and time, but did not divide the battle space geographically according to land, sea, and air. NFN is the Naval subset of joint Fires.

Relationship to warfighting challenges (2007): The timely engagement and assessment of TSTs by Joint forces across components presents the following warfighting challenges:

- Establishment of a timely, accurate COP/CROP.
- Application of effective cross-component collaborative capabilities.
- Timely integration of Joint capabilities against tactical objectives.

Initiative Definition: Design and deliver a Joint Fires C2 network. The primary tool was ADOCS/LAWS software that was modified to incorporate a joint TST Mission Manager (i.e. DTL Manager) function that was used for C2 among component level commands and the Joint Task Force. The Joint Fires Initiative required that a TST be developed and nominated by one component and the mission passed by the supported Commander, to another component for execution.

Overarching Questions

- Did the proposed (experimental) joint targeting (cross-component) architecture enable timely engagements of TSTs?
- In what ways did a common toolset within the joint architecture improve the ability of the joint force to conduct effective cross-component TST operations?
- The initiative required the design and delivery of a joint Fires C2 network. The primary system of this network was ADOCS, modified to incorporate a joint TST mission manager (i.e. the Dynamic Target List (DTL) Manager) function that was used for C2 by the component level commanders and the Joint Task Force. The Joint Fires initiative required that a TST be developed and nominated by one component, and the mission passed by the supported commander to another component for execution

2.3 High Speed Vessel (HSV)

Description: The FBE-J/MC02 High Speed Vessel (HSV) joint initiative was a major milestone in the Joint HSV Project. The HSV project is a joint, multiyear effort between the Army, Navy, Marine Corps, and Naval Special Warfare Command. The project explores the concepts and capabilities associated with commercially available advanced hull and propulsion technologies integrated with advanced communications technology. New designs for surface vessels permit significantly increased speeds that can improve support for Intra-theater logistics and combat service (logistics movements within the operations area). Other characteristics possessed by the HSV appear to be particularly well suited to littoral operations, especially mine warfare, command and control, and possibly support to medical forces.

For MC02/FBE-J, there were two test-bed HSVs (Joint Venture (HSV-X1), and Sea SLICE) serving as surrogate platforms in a number of LOEs. HSV-X1 is a semi-planing wave-piercing aluminum catamaran originally built and operated as a commercial high-speed car and passenger ferry. The project leased HSV-X1, made enough modifications to the vessel to support experimentation and demonstration needs, and installed an advanced (and experimental) C4I system. The Sea SLICE is a small waterplane twin hull (SWATH) ship owned and built by Lockheed Martin on behalf of the Office of Naval Research as a technology demonstrator. While significantly different in size and capabilities, both of these unique platforms are a departure from traditional Navy monohull ships. FBE-J was a valuable opportunity to demonstrate the technology of these two vessels.

In addition to the test bed platforms, 5 simulated HSVs (Agile, Aggressive, Exultant, Impervious, and Hercules) also participated in the experiment. All of these vessels are more fully described in chapter 7.

HSVs' participation in FBE-J/MC 02 provided an opportunity to validate previous LOE findings in an operational setting. Against the backdrop provided by the experiment scenario, the Project's partners put the vessel and their experimental systems and concepts through their paces. Joint Venture's ability to support alternative mission configurations was tested as first multiple mine warfare (MIW) functions were exercised; followed by simultaneous MIW C2 (MIWC) and Naval Special Warfare (NSW) operations; simultaneous MIW C2, NSW C2, and Marine Corps ship-to-objective-maneuver (STOM) operations; simultaneous logistics, surveillance, and NSW operations; and closing MC02 with an Army validation of its ability to conduct an operational retrograde of a Stryker Brigade Combat Team (SBCT). In addition to Joint Venture's participation, FBE-J/MC02 provided an opportunity to:

- Conduct mine countermeasures, fires, surface warfare, and NSW experimentation with Sea SLICE.
- Experiment with a simulated force of five HSVs operating as a force of Littoral Surface Combatants to explore Fleet concepts of operation (CONOPS).
- Test the HSVs' ability to quickly reconfigure in support of different mission areas.

Relationship to Warfighting Challenge in 2007: HSV technology in Joint Venture leverages proven commercial design to bring an added dimension to modern naval warfare. Commercial shipyards already manufacture vessels with a number of militarily relevant capabilities including high-speed, long range at endurance speeds, reasonably good sea keeping ability, shallow draft, and rapid adaptability to multiple, changing missions. Additionally, the cost and manning requirements of a militarized version of these vessels is estimated to be substantially less than that of a more traditional military ship of comparable size and capability. To the extent these commercial vessels can be further modified to meet military needs, they potentially offer significant, near term capabilities.

In 2007 these enhanced capabilities could offer clear advantages to the Joint Force Commander (JFC). An HSV's inherent speed and ability to operate from austere ports enhance its operational mobility and reduces an enemy's ability to maintain situational awareness across extended battlespace. As sensors improve in numbers and capabilities, the HSV's ability to deploy manned and unmanned sensors, collect, process and disseminate information, and host a forward-based commander and his staff will become increasingly important to gaining and maintaining situational awareness. The HSVs' increased mobility and situational awareness create new opportunities to exploit those advantages. Ship design characteristics in the HSV such as high speed, high payload fraction, minimal manning requirement, and shallow draft lend themselves to sustaining combat forces across the access battlespace. Enable by system interfaces and a baseline architecture built into an HSV's command, control, communications, computers, and intelligence (C4I) system, the HSV's ability to accept C4I modules extends the JFC's ability to push his command and control forward into the battlespace.

The improvement in capabilities that HSV technology offers has direct applications in Rapid Decisive Operations (RDO) as they provide the JFC an enhanced ability to accelerate his tempo of operations. As a result, HSV technology creates opportunities for developing transformational operational concepts aimed at bringing military power to bear from long range at responsive speeds.

Initiative Definition: The High Speed Vessel Joint initiative was part of a yearlong series of experiments that explored the military use and suitability of advanced hull and propulsion technologies integrated with advanced communications technologies. For FBE-J/MC02 there were two test-bed HSVs (JOINT VENTURE (HSV-X1), and SEA SLICE). In addition to the test bed platforms, 4 simulated HSVs (AGILE, AGGRESSIVE, EXULTANT and IMPERVIOUS) also participated in the experiment. As an enabling technology, the HSV initiative overlapped other FBE-J/MC02 initiatives, as described below.

Sub-initiatives: The HSV sub-initiatives provided context and interactions between maritime missions and potential HSV roles. HSV evaluations and analyses extended across a number of mission areas, e.g., MIW, Naval Special Warfare (NSW), support to Ship to Maneuver (STOM), and Joint support (e.g., IBCT redeployment and logistics ashore). The relationships between hull-type and the capabilities resulting from this hull form, and design for multi-purpose roles was the central analysis perspective in FBE-J.

In support of different missions, both the test-bed ships and simulated HSVs were reconfigured and switched between missions during the experiment. Free-play within the scenario simulation also resulted in mission shifts and was an additional source of important data.

Overarching Questions

- What additional value added did having a number of high speed, reconfigurable, and multi-mission platforms provide the JFMCC and JFC in a littoral campaign as part of an access mission?
- What are the appropriate missions best suited to this concept of maritime operations?
- In a netted environment with many and varied types of sensors, what are the advantages or disadvantages of the C2 construct used in this concept?
- What conditions and design features must be considered in engineering the capabilities requisite in meeting the challenges in a 2007 campaign?

2.4 Naval Fires Network – Experimental (NFN (X))

Description: This initiative was to provide support for fully autonomous platforms that were capable of performing all aspects of targeting and to simulate future power projection platforms and weapon systems.

Relationship to warfighting challenges in 2007: In 2007, the timely engagement and assessment of TSTs by the JFMCC will present the following warfighting challenges:

- Establishment of a timely, accurate COP/CROP.
- Maintenance of effective collaborative capabilities among and within engagement nodes.
- Timely integration of capabilities against tactical objectives.

Initiative Definition: The Naval Fires Network (Experimental) initiative in FBE-J / MC 02 was designed to implement experimental Navy targeting systems and processes. These support joint targeting and Fires requirements across service components, up to CJTF and down to tactical Naval forces, using defined CONOPS, TTP, systems, architecture, and organization. Navy Fires was to project power ashore through the integration of long-range surface, sub-surface, and air-delivered fires.

Overarching Questions

- What was the contribution of Naval platform self-targeted engagements to the TST engagement problem?
- What are the operational planning and employment considerations required for the effective utilization of future power projection platforms in the TST engagement process?
- How successful was the defined TST architecture in engaging asymmetric TST targets?
- How successful were Naval platforms in responding to multi-mission tasking?
- What was the contribution of the Mensuration Manager to the TST process?
- What did the introduction of a ground COP contribute to the TST process?

2.5 Intelligence, Surveillance, Reconnaissance Management (ISRM)

Description: This initiative was to integrate the management of the JFMCC, ISR planning and execution, asset management, manning requirements, Unattended Ground Sensors (UGS), and multi-platform SIGINT tracking, with dynamic ISR management.

Relationship to warfighting challenges in 2007: In order to reduce the time needed to make critical decisions, particularly with regard to TCTs, it is vital to improve the efficiency of managing various ISR systems. It is likewise important to improve the efficiency in the construction and management of the resultant comprehensive database and COP/CROP in order to make optimal decisions in minimum time.

Initiative Definition: The primary objective of this sub-initiative was to provide a representative construct from which UAV ISR assets (e.g. a tiered-UAV architecture) can support the Maritime Planning Process (MPP), Joint Dynamic ISR Management (JDISRM), Time Sensitive Targeting (TST), and Assured Access (AA) experiment initiatives. In doing so, the areas of tactical utility, connectivity, and C2 structures (e.g. concept of operations) of a tiered UAV ISR&T architecture, as well as the required level of effective control of UAV assets to allow for dynamic management, could also be explored. For the experiment, Global Hawk, Joint Operational Test Bed System (JOTBS), and Pioneer UAVs were used to examine UAV tasking, data processing, exploitation and dissemination afloat.

Overarching Questions

- Can dynamic ISR management be effectively employed to engage high priority targets?
- Can unattended ground sensors and unmanned aerial vehicles be effective sources of information for DISRM?
- Are the communications links sufficient for the purpose?

2.6 Mine Warfare (MIW)

Description: The overall objective of the MIW experiment in FBE-J was to examine the application of network-centric warfare concepts and other emerging technologies as they might apply to mine warfare.

Relationship to warfighting challenges in 2007: In 2007, the littorals will be increasingly important and challenging for maritime and joint forces to access quickly and safely. New platforms such as High Speed Vessels (HSVs), and technological advances in sensor capabilities increase the organic MCM capability and present the MIWC with organizational, resource allocation, information, and C2 challenges, only partially addressed in FBE-J.

Initiative Definition: The command and control structure in FBE-J encompassed an experimental organization, an HSV as a surrogate future Mine Warfare Command and Support Ship (MCS) capable platform, new command and control equipment, and some new MCM capabilities, which replicate future MCM capabilities in the 2007-2010 time frame.

Overarching Question: How can the efficiency and effectiveness of mine warfare be enhanced through the use of network-centric operations?

2.7 Anti-Submarine Warfare (ASW)

Description: The anti-submarine warfare (ASW) initiative in FBE Juliet addressed tactical, operational, and command decision processes within this warfare area.

Relationship to warfighting challenges in 2007: Network-centric ASW is the underlying concept for success in ASW in littoral waters. This concept of multi-level commands and multi-disciplinary forces, well-connected by common communications, and guided by solid doctrine, planning tools, and commander's guidance will be central to rapid and successful prosecution of submarines in these complex and dangerous situations.

Initiative Definition: There were four ASW sub-initiatives in FBE-J:

- The submarine locating device initiative investigated the operational concept of installing submarine locating devices. This included issues of when, where, and how to achieve the installation, and what type of capabilities the locating devices should have. The problems of permissive ROE were considered. Submarine Locating Device signals were utilized in the ASW picture.
- The remote autonomous sensor initiative investigated the ability of remote, autonomous systems to independently identify submarine contacts and report them in real time or near real time. The purpose was to determine if remote autonomous sensors could, if necessary, provide the commander the ability to effectively cover large areas without risking manned assets, yet be able to attack threat submarines efficiently with the use of air assets.
- The experimental common undersea picture initiative provided basic tools for network-centric ASW. It had three major functions that provided the backbone for this operational concept: force collaborative planning, shared situational awareness, and common dynamic tactical decision aids.
- Using the experimental naval Fires network for ASW Targets sought to determine if incorporating ASW targets in the experimental Navy Fires network (NFN (X)) in conjunction with the Land Attack Warfare System (LAWS) could improve the ability to attack ASW targets successfully as time critical targets.

Overarching Question: How can network-centric ASW operations improve detection, classification, localization, and neutralization of enemy submarines to assure rapid and successful maritime access to, and operations in, littoral regions of interest?

2.8 Information Operations (IO)

Description: The FBE-J Information Operations initiative was designed to provide the full range of IO capabilities (Offensive, Defensive, and Collaborative) in support of the JFMCC planning process. It incorporated experimental and emerging organizational constructs, processes and capabilities to accommodate simultaneous offensive and defensive operation at the tactical and operational levels.

Relationship to warfighting challenges in 2007: As the number of sensors, platforms, exploitation sites, and command and control nodes continue to proliferate with advances in technology, commanders and analysts require assurance that data, information, and knowledge, are being managed effectively and efficiently. Likewise, any disruption that we can create in opposition force data flow, which will confuse or delay decision making by the opponent, provides us with a relative advantage. The role of IO and the IO Cell is to simultaneously protect friendly information and information systems while denying, degrading, disrupting, and destroying the adversary's system to produce a more favorable information differential between the two.

Initiative Definition: The following four sub-initiatives comprised the IO effort and were researched during FBE-J:

- IO enrichment to the JFMCC planning process.
- Collaborative IO planning.
- Defensive IO – Computer Network Defense.
- Offensive IO – Tools incorporated to support deliberate and time critical targeting.

Overarching Question: Is IO sufficiently incorporated into the MPP operations to yield high quality products, information, guidance, and feedback to support the MTO generation process?

2.9 Coalition Command and Control (Coalition C2)

Description: The operational commander should be able to ensure that coalition partners are assets to enhance relevant information exchange, and not a liability that could potentially decrease speed of command. The use of coalition forces can reduce the risk to US forces, and increase nodal sensor (or weapons) coverage, as long as architecture exists to support their integration.

Relationship to Warfighting Challenge in 2007: Coalition operations, including those of ad hoc coalitions, have been a fundamental reality in virtually every recent operational engagement of the U.S. Navy and multi-service forces. Examples include operations Desert Storm, Allied Force, Joint Forge/ Guardian, and Enduring Freedom. Coalition operations will be most effective if they serve as not only a political instrument of national power, but contribute to the warfighting effectiveness of the combined forces. Situational awareness that combined Naval operations should be able to leverage might be compromised by the varying strengths that regional coalition partners bring to a theater of engagement. Interoperability is a potential source of friction between network-centric warfare and multi-national operations. There are also potential concerns among allies and coalition partners that the disparity in technology advancement between partners, particularly network-centric warfare, will inhibit effective coalition command and control.

Initiative Definition: The initiative addressed the following warfighting challenges:

- Multi-national interoperability.
- Dynamic reconfiguration of networks supporting multi-tasked platforms or those with disadvantaged or intermittent C4 capabilities.
- Reliability of network-centric architectures to exchange relevant information for distributed planning and decision-making.
- Needs for a better mechanism to support secure information sharing to enhance the coordination of operational forces while protecting national sources and data deemed not releasable.
- The extent of future desired operational capability supported.
- Information Superiority.
- Secure cross-service, -platform, -discipline, -echelon, -coalition and -agency integration
- Real-time battlespace awareness.
- Comprehensive battlespace awareness to support the full range of military operations.

Overarching Questions

- Can a coalition force be effective and dynamic, reconfigurable, and tailored to the threat and theater?
- Can partners join and leave C2 networks with minimum difficulty?
- Can national information data and sources be protected while decision-making with a coalition force is shared?

2.10 Netted Force (NF)

Description: This initiative consists of three sub-initiatives: Knowledge Management Organization (KMO), Collaborative Information Environment (CIE), and Ground COP. All are designed to improve the management of, and access to, information within the battle force to permit fast, confident decision-making.

Relationship to warfighting challenges in 2007: The proliferation of data from disparate source sensors, particularly those generating continuous data streams, the potential reduction in platform signatures, and the concomitant increases in speed and lethality of weapons systems all mandate efficient distribution and management of information in order for a joint force to make the best decisions in battle.

Initiative Definition

- Knowledge Management Organization (KMO) Initiative focused on the Knowledge Information Officer who answered directly to the JFMCC and coordinated the JFMCC Commander, Chief of Staff, and Battlewatch Captain to ensure that watch team knew where to find critical information.
- Collaborative Information Environment (CIE) Initiative focused on the ability of the CIE to support rapid decisive operations by giving the commanders the information they need to have confidence in their decisions.
- Ground COP Initiative- attempted to automate the linkage between traditional COP track management, engagement tools, target management, and intelligence order-of-battle tools using the capabilities of the emergent GCCS 4.X architecture.

Overarching Questions

- Does the netted force (NF) support improved planning and execution by improving the commander's situational awareness while decreasing information overload?
- Does the KMO concept provide for improved bandwidth management in support of combat operations?
- Does the NF improve the understanding and decision making of tactical ground forces?

2.11 Joint Theater Air Missile Defense (JTAMD)

Description: Navy Theater Air and Missile Defense (TAMD) capability was hosted as one of the multi-functional capabilities onboard select surface combatants.

Relationship to Warfare Challenge in 2007: Navy Theater Air and Missile Defense (TAMD) capability will be hosted as one of the multi-functional capabilities onboard surface combatants. Navy planners will require solutions that balance joint (critical asset defense) and maritime (force protection and access) requirements and effectively, and more optimally, employ limited numbers of ships in a dynamic battlespace environment. Doctrine and organizational constructs will have to support the command, control, and coordination of capabilities simultaneously shared by Navy and Joint commanders. Evolving innovations in technology include improvements to the Area Air Defense Commander (AADC) module to develop and evaluate alternative courses of action. Evolving weapons technical capabilities include sea-based mid-course and terminal phase TAMD capabilities, Cooperative Engagement Capabilities (CEC), and improvements in weapons platforms such as the enhanced E-2 and F/A-18 aircraft.

Initiative Definition: FBE-J provided the dynamic interactions necessary to further mature joint TAMD/AAW operations for TACMEMO development. Data were collected with respect to command relationships and mission planning processes to optimize allocations of multi-mission TAMD capabilities on surface ships, using the capabilities of an AADC module. System elements were evaluated for joint employment, providing input to a future USN AADC module TACMEMO and to mature the initiative for further refinement and analyses in upcoming LOEs and FBEs. JTAMD sub-initiatives were designed to define further the internal processes developed within the AADC module to support the JFMCC's Maritime Planning Process (MPP) and to provide guidance for the interaction of Navy TAMD with JTAMD.

Overarching Questions

- Can a single commander appointed as both the battle force Air Defense Commander (ADC, also AW) and a Regional Air Defense Commander (RADC), supported by the AADC Module planning capability and process, effectively support the air and missile defense requirements of both commanders?
- Does the capability to rapidly wargame alternative courses of action with the embedded war gaming (M&S) capability and to provide graphic displays provide value added to the Joint Force Maritime Component Commander (JFMCC) and Joint Forces Air Component Commander (JFACC)?
- What emerges as functional relationships between the JTFHQ (production of the Effects Tasking Order and/or the Defended Asset List), the JFMCC (Maritime Tasking Order), and JFACC/AADC (Air Tasking Order)?
- What emerges as the organizational relationship between the SJTFHQ Theater Missile Defense (TMD) Cell, JFACC/AADC, Deputy Area Air Defense Commander (32nd AAMDC), Regional Air Defense Commanders (RADC), and the maritime Air Defense Commander?
- What elements of the experimental organization, TTP and C2 learned from this event are suitable for inclusion in a future USN AADC module TACMEMO?
- Does the JFMCC Maritime Planning Process mitigate the dilemma posed by competing demands for multi-purpose surface combatants?

2.12 Sea-based Command and Control (Sea-based C2)

Description: This initiative analyzed the potential for network-centric computing to support the objectives of a sea-based CJTF, and provided insight to the manning structure and functional capability of the JFHQ.

Relationship to Warfighting Challenge in 2007: The network-centric computing paradigm of the near future can provide a vastly improved exchange of information, with improved situational awareness and greatly reduced response times, thus streamlining the execution of battlefield scenarios. This will require improved data communication capability in terms of bandwidth, reliability, and accessibility. Fleet Battle Experiment - Juliet (FBE-J) was a platform to demonstrate these increased capabilities and to test the feasibility of network-centric solutions to naval warfighting situations of the future.

Initiative Definition: Network data were collected to determine the necessity, sufficiency and effectiveness of the wide-area network connections used in FBE-J. An assessment was made as to the effectiveness of the COP in supporting sea-based command and control.

Overarching Questions

- Document the CJTF staff perceptions of their capabilities as a CJTF that is sea-based within the context of the MC02 scenario and FBE-J/MC02 architecture.
- Are the manning, structure and functional capability of the JFHQ sufficient for the requirement?
- Is the “reachback capability” of the JFHQ (Forward), on-board USS CORONADO, to the JFHQ (Main) at Suffolk, VA, sufficient to ensure information superiority?

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Section II: Principal Results

(These principal results are also contained in the Final Summary Report.)

3.0 Principal Results

3.1 Summary of Findings

The following principal results have been extracted from this report's key observations. They are a fraction of the results that were obtained from the experiment. They are deemed to be the most significant for reasons such as operational impact, importance of further study, etc.

These results have been determined under conditions that existed during FBE-Juliet. Whether they are applicable outside those conditions is speculative. Section II of this report provides an abbreviated description of the general context for the experiment. A more complete description can be found in the Reconstruction and Analysis Report. Section III provides a brief description of the context as related to any experiment, followed by the specific context that is pertinent for each initiative. These two Sections will allow one to assess the validity of these principal results and the conditions for which they apply. It also allows one to plan the conditions under which further experimentation should be carried out.

Each principal result is presented in two formats. The first format is a set of brief summary points presented as in a table. The second is a brief description of each point on the same page. These formats can be used for presentations, with the first being projected and the second to verbally describe the results. Again, full descriptions of these results can be found in the Reconstruction and Analysis Report.

A semantic difficulty has been encountered in presenting these results. The distinction between a time sensitive target (TST) and a time critical target (TCT) has been lost in current common usage. Their definitions are:

- **TST**. A target that is to be attacked by a particular time. Such a target can be on the deliberate targeting list.

- **TCT**. A target that "appears" and must be attacked within a definite time period. This target will be on a priority list, but will not be on the deliberate targeting list.

TCTs are a special class of TST. It is important to differentiate because they are managed differently and conclusions with respect to the ability to manage them can differ.

MPP #1 - The Maritime Planning Process Is Viable

- All required tasks were executed and required products produced.
  - Full process from ETO ingestion to MTO production executed
  - Three overlapping, 72-hour planning cycles executed simultaneously

- The range of planning done in the experiment was limited.
  - Competition for assets between PWCs was largely nonexistent.
  - Execution results were not fed back into the planning cycle.
  - There was no determination of the plans' quality.

- Process difficulties need to be addressed.
  - Individuals needed to multi-task; there is no process for coordinating tasks with individual availability.
  - Synchronization was ad-hoc rather than a planned process.

<u>Maritime Planning Process #1</u>

The maritime planning process (MPP) was implemented by a staff structure under the Joint Forces Maritime Component Commander (JFMCC). Effects tasking orders (ETOs) from the Joint Forces Commander (JFC) were ingested, and maritime tasking orders (MTOs) were produced and coordinated with the air tasking order (ATO). Principal warfare commanders (PWCs) participated in the process, producing maritime support requests (MARSUPREQs) that were a component of MTO production. Three overlapping planning cycles of 72-hours each were simultaneously executed. The process executed all required tasks and produced required products.

Applicability: The range of planning done in the experiment was limited. The range of situations that the process can manage is unknown.

- Competition for assets between PWCs was largely nonexistent. The process was not stressed.
- There was no MTO-ATO feedback cycle for plan adjustment.
- There was no determination made of the plans' quality.
- Execution results were not fed back into the planning cycle; no process exists to do this.

MPP details and causes. It was observed that the MPP is viable, but also observed was that the process did not go well. Principal problems and their causes were:

- The need to simultaneously support three planning cycles with a limited number of individuals appeared to be a primary cause for process difficulties. Individuals needed to be multi-tasked, and there was no process for coordinating tasks with individual availability.
- A high level of synchronization of tasks was needed, along with the information that supports the tasks, and the individuals that perform them. Synchronization was ad-hoc rather than a planned process.
- Various inputs to a given MTO were observed to contain essentially the same content as submissions for previous plans, creating the impression of resubmission rather than new plan development. The cause for this duplication is not known, nor whether it is a real problem. Possible causes are overloading of multi-tasked individuals and information synchronization difficulties.

Recommendation

- Assume at this time that MPP should be implemented and refer to the following MPP principal result for pre-implementation requirements.

MPP #2 - MPP Implementation Study Needed

- Little information is available for MPP improvement.

- Further progress with MPP requires:
  - Detailed mapping of the planning architecture
  - Parameterization of planning sub-processes
  - Mapping of planning decision processes
  - Mapping of information flows that support planning and decisions
  - Better personnel assignments to tasks

- Process modeling is required.
  - Develop a detailed MPP process model
  - Parameterize the model with data from FBE-J and other experiments
  - Determine from model simulation runs how to synchronize the process
  - Determine MPP personnel requirements and multi-task coordination
  - Determine how to synchronize asynchronous feedback from execution

<u>Maritime Planning Process #2</u>

MPP principal result #1 identifies that the process is viable, that difficulties remain to be resolved, and overarching problem areas. The experiment revealed process problems but provided little information about how to resolve them.

MPP implementation context. It is assumed that the MPP will be implemented with staffing that is approximately the same as in FBE-J. This means that personnel multi-tasking and synchronization of tasks, supporting information, and the identification of the individuals performing tasks will be required.

A process is needed to feed back information into all three planning processes on the results of actions and executions. An effects cell and a process for synchronizing its output with planning cells are proposed, and definition of this process is required.

Recommendations

Further progress with MPP requires detailed mapping of the planning architecture, parameterization of planning sub-processes, mapping of planning decision processes and information flows that support the decisions, and better personnel assignments to tasks. Process modeling only can do this. Specifically:

- Develop a detailed MPP process model. This should be done for both the system tested in FBE-J and for the more comprehensive system needed for adequate MPP execution.
- Parameterize the model with data from FBE-J and JFMCC limited objective experiments (LOEs). Run the model to identify principal process shortfalls.
- Determine, from a model, how to synchronize the process. Model iterations and runs can identify requirements.
- Determine MPP personnel and multi-task coordination requirements from a model.
- Determine how to use an effects cell to synchronize the asynchronous feedback from execution.

HSV #1 - HSV Rapid Reconfiguration For Different Missions Is Viable

- HSV reconfiguration was accomplished for:
  - C2 platform for MIWC and MCM operations
  - Navy Special Warfare
  - Intra-theater lift/movement of a brigade combat team unit
  - Sensor management platform
  - Support for helicopters, small boats, USVs, and UUVs

- Five reconfigurations accomplished, time for each less than one-half day

- Further tests for more configurations and operations needed:
  - Reconfiguration profiles, their difficulty levels, resource needs, and times to accomplish
  - Fits between reconfiguration profiles and orders of battle
  - CONOPS and TTP for HSV use and reconfiguration for littoral warfare
  - Numbers of ships needed to support various operations
  - Optimal reconfiguration profiles to minimize the required number of ships

<u>High Speed Vessel #1</u>

During the experiment HSV-X1 was reconfigured five times, with time to achieve reconfiguration never more than one-half day. It was tested as a command and control (C2) platform for Mine Warfare Command (MIWC) as well as for mine countermeasures (MCM) operations, Navy Special Warfare (NSW), intra-theater lift/movement of a brigade combat team unit, and a sensor management platform. Opportunities arose during the experiment to provide support for helicopters, small boats, unmanned surface vehicles (USVs), and unmanned underwater vehicles (UUVs).

Applicability: A subset of possible HSV missions was tested during the experiment. The full range of missions an HSV can support, and the numbers of ships needed to support a particular mission are not yet known. Reconfiguration works, but will have differing difficulties and times to accomplish, dependent on specific missions.

An operation may involve more than one HSV. Varying numbers of ships will be involved in the various missions within the operation. The number of ships to be reconfigured, and the schedule, will depend on how missions and ships use are synchronized. A process will be needed to optimize reconfiguration.

Recommendations

Studies should be undertaken immediately to determine:

- Reconfiguration profiles, their levels of difficulty, resource needs, and times to accomplish
- Numbers of ships needed to support various operations
- Fits between reconfiguration schedules and orders of battle
- CONOPS and TTP for HSV use and reconfiguration for littoral warfare
- The optimal reconfiguration profiles necessary to minimize the required number of ships.

HSV #2 - HSV is Able to Operate as a Simultaneous, Multi-Mission Platform

- HSV-X1 simultaneously conducted MIWC, MCM, and STOM operations.

- A subset of possible HSV simultaneous missions was tested. Outstanding questions:
    - Efficient single ship multi-mission profiles
    - How more than one ship would support several missions
    - How to coordinate multi-missions within and between HSVs

- Undertake studies to determine:
    - Needed simultaneous multi-mission support for various orders of battle
    - Manning required to support single-ship multi-mission capabilities
    - Required information exchange and coordination for multi-ship simultaneous missions

High Speed Vessel #2

During the experiment HSV-X1 conducted MIWC, MCM, and STOM operations simultaneously, while also functioning as a forward deployed sensor management/C4ISR platform.

Applicability: A subset of possible HSV simultaneous multi-mission support was tested during the experiment. Multi-mission support with a small platform works, but the extent to which such support can be provided is not known.

A single ship can perform two or more missions simultaneously. However, it is not known which multi-mission combinations are most efficient and for which mission conflicts might arise. This needs to be determined before multi-mission tactics, techniques, and procedures (TTP) can be developed.

How the Navy would use more than one ship to support several missions, and coordinate their activities has not been investigated. A combination of single-mission and multi-mission HSVs could be the preferred option.

Coordination of the activities of all HSVs will be required. Planning such coordination would be a part of the MPP, would necessarily involve the HSVs, resulting in a distributed JFMCC. Standard operating procedures (SOPs) for command and control (C2) of multiple HSVs operating in the littoral, with an HSV as the principal C2 ship, must be developed.

Recommendations

Studies should be undertaken immediately to determine:

- Needed simultaneous multi-mission support for various orders of battle
- Manning required for support of single-ship multi-mission capabilities
- Required information exchange and coordination for multi-ship simultaneous missions
- TTP for multi-ship, multi-mission command and control.

HSV #3 - HSV Vulnerabilities Not Understood

- Concern emerged about HSV vulnerabilities, even to small arms fire

- No information was obtained during the experiment to address this issue.

- A study should be conducted to:
  - Determine likely threats to an HSV operating in the littoral
  - Determine HSV vulnerabilities to these threats
  - Develop force protection systems and processes against those threats
  - Test and train to these force protection measures.

<u>High Speed Vessel #3</u>

Concern emerged about HSV vulnerabilities, even to small arms fire. No information was obtained during the experiment to address this issue.

Planned HSV operations are in the littoral. This will put it within range of numerous threats in addition to those normally faced by Navy ships: shore batteries, small surface and air craft, hand-held launchers, small arms, etc. Threats can emerge rapidly, with little warning. Protection systems and processes that allow rapid reaction are needed.

Physical vulnerabilities of these ships to a wide range of fires are not understood.

Recommendation

Conduct a study to:

- Determine threats that are likely to be encountered by an HSV operating in the littoral.
- Determine the vulnerabilities of the current HSV to these threats.
- Suggest the capabilities needed for new HSV designs.

New training procedures will be needed for these force protection measures.

HSV #4 - HSV Sleep Patterns May Interfere With Duty Performance

- Sleep quantity and quality were substantially less than sailors working nights during combat.

- Small number of test cases studied, factors neglected were:
    - Data compromise due to greater motion of an HSV
    - If HSV tasks more or less subject to interference from sleep deprivation
    - Effect of low manning and fast pace of HSV operations

- Studies are needed to:
    - Develop a methodology to account for HSV motion.
    - Perform a comprehensive study of HSV sleep patterns.
    - Determine if HSV duties' pace is unusual with respect to other Navy operations.
    - Compare HSV sleep patterns with those of personnel performing equivalent.

High Speed Vessel #4

Comparisons of data taken on the HSV with data previously obtained indicate that the quantity and quality of sleep are substantially less than that of USN recruits during boot camp and sailors working nights during combat. Current human factors research indicates such sleep patterns lead to greatly increased risk of mishaps due to lapses in attention and fatigue.

Applicability: These results are preliminary, from a small number of test cases. Factors such as data compromise due to the greater motion of an HSV have not been taken into account.

It is not known if tasks aboard the HSV are more or less subject to interference from sleep deprivation. Because of low manning and the fast pace of HSV operations, this may be a more critical factor than on other ships.

There has as yet, been no comparison of individual HSV tasks with equivalent tasks on other ships. Such studies should determine if there are substantial differences in the expectations of how tasks are to be performed, as well as a determination of sleep patterns.

Causes: It is possible that ship motion and pace of operations could be contributing factors to sleep deprivation. Causes are not understood, and their determination must wait until further data are obtained to determine if sleep deprivation is a real effect.

Recommendations

- Develop a methodology to determine sleep patterns in the presence of HSV motion.
- Perform a comprehensive study of HSV sleep patterns.
- Determine if the pace of HSV duties is unusual with respect to other Navy operations.
- Compare HSV sleep patterns with those of personnel performing equivalent Navy tasks.

COP #1 - GCCS-M Information Inconsistencies Exist

- GCCS-M versions 3.X and 4.X show inconsistent track information.

- GCCS-M displays on different platforms sometimes showed different information.

- Causes for inconsistencies and the impact of this observation are not known.
    - Reliability of the COP can be questioned.
    - Magnitudes of differences are not known.
    - Potential impact on operational decision-making is not known.

- An immediate study should be undertaken to determine causes and fix the problem.

<u>Common Operational Picture #1</u>

During the experiment, track information was displayed on both 3.X and 4.X versions of the Global Command and Control System-Maritime (GCCS-M) and on different platforms. There were instances of information not being the same on the two versions and between platforms with 3.X. The extent and magnitude of inconsistencies are not known.

Causes: The causes of the inconsistencies are not known.

Impact: This observation causes the reliability of the common operational picture (COP) to be questioned. However, the significance of this difference is not known, either in terms of the magnitude or potential impact on operational decision-making.

It is believed that this is a technical problem that may have an easy fix. Thus, determination of the impact of the observed differences on operations is not deemed an efficient use of resources. Effort should be expended on finding the cause and solution to the problem.

Recommendation

- Determine the reason(s) for the differences and fix the problem.

ASW #1 - CUP Tools Provide Needed ASW Support

- Provided shared understanding of environment and support for collaborative planning

- Advantages and limitations of the tools were:
  - Improved planning of optimal search patterns and execution monitoring
  - No information obtained on use in conjunction with or part of COP
  - Connectivity with submarines is a significant limitation
  - Chat monitoring required almost a full-time person
  - TTP required for efficiency and to control information quality

- Studies should be undertaken to:
  - Develop a consistent set of TTP, tools, manpower needs, and training.
  - Determine bandwidth and connectivity requirements for all platforms.
  - Determine any needed CONOPS changes for CUP implementation.
  - Determine total system loading for CUP used in conjunction with other information systems.

Anti-Submarine Warfare #1

Common tools, networked to common data sources, provided needed support for distributed, collaborative planning. Shared understanding of the undersea environment was produced. Production and use of an ASW Common Undersea Picture (CUP) is viable and will enhance ASW capabilities.

Applicability: No information was obtained on use of the CUP in conjunction with, or as part of other COP systems, such as GCCS. Possible competitions for bandwidth and personnel attention have not been evaluated.

Advantages and limitations of the tools were:

- The CUP enabled collaborative planning of optimal search patterns and monitoring of execution.
- Connectivity between submarines and the force is a significant limitation. Bandwidth and connectivity must both be considered for a solution.
- Chat was one of the primary collaboration tools and used extensively. Efficient collaboration by this means appears to require almost full-time monitoring, which is probably unacceptable and indicates some type of scheduling is needed.
- There are no rules for who may provide information or for controls on information content. Support tools use-discipline is required for efficiency and to control information quality.

Recommendations

- Develop a consistent set of TTP, tools, manpower needs, and training for a CUP.
- Determine bandwidth and connectivity requirements for all platforms participating in ASW.
- Determine any changes needed in CONOPS for CUP implementation.
- Determine total system loading for CUP used in conjunction with other information systems.

ASW #2 - Remote Unmanned Sensors Improve ASW Operations

- Sensors utilized:
  - Bottom-moored acoustic arrays
  - Unmanned surface vehicles (USVs)
  - Submarine-locating devices (SLD)

- Advantages and limitations:
  - Pre-hostility SLD reports enabled optimization of Blue-force assets.
  - ADS success requires advanced identification of critical locations and choke points.
  - USV sensors did not function as designed.
  - Seaworthiness of USVs and included sensors is a problem.

- Improved use of these sensors requires:
  - Develop USV and sensor seaworthiness and maintainability requirements.
  - Development of TTP for the coordinated use of various sensors.

Anti-Submarine Warfare #2

Bottom-moored acoustic arrays, unmanned surface vehicles, and submarine-locating devices (SLD) provided valuable information for localization and attack prosecution.

Advantages and limitations of the tools were:

- Periodic reports from SLD during pre-hostilities provided sufficient information to allow Blue-force assets to be assigned to search exclusively for unreported submarines.
- It would be desirable to be able to prompt SLD reports rather than operate on a pre-determined schedule.
- A portion of the success of an Advance Deployable System (ADS) field was due to identifying critical locations and choke points for installation of a sensor field ahead of time and concentrating installation there.
- The ability to coordinate USVs with air ASW platforms was demonstrated, however sensors did not function as designed.
- Seaworthiness of USVs and the included sensors is a problem.

Recommendations

- Develop a set of seaworthiness and maintainability requirements for USVs and their sensors.
- Develop TTP for the coordinated use of various remote, unmanned sensors.

ASW #3 - NFN (X) Use For ASW Had Limited Success

- LAWS and GCCS-M were used for ASW engagements.
- Non-NTDS platforms realized the most benefit from the system.
- Greater utility would be realized from incorporation into existing submarine weapons control systems and/or surface ASW tactical data systems.
- LAWS occasional latency of several minutes is unacceptable for this application.
- Before further testing of NFN (X) for ASW:
  - Develop plans for fusion with existing ASW information.
  - Develop combined information displays.

Anti-Submarine Warfare #3

The use of the NFN (X) systems, especially LAWS and GCCS-M, for ASW engagements was investigated. Opinions about the usefulness of these systems are mixed.

System usefulness context: There was a pattern to perceptions about the usefulness of these systems. Personnel on platforms that do not use the Naval Tactical Data System (NTDS) and other tactical data links viewed the system as providing added value.

Applicability: The usefulness of this approach is not known for situations where there are simultaneous, intensive operations, such as air and ASW. Ultimately, tests will have to be undertaken under expected battle rhythm and conditions.

System limitations

- The systems would have greater utility if incorporated into existing submarine weapons control systems and/or surface ASW tactical data systems. Dealing with an additional and separate system is difficult.
- LAWS' occasional latency of several minutes makes it unacceptable for this application.

Recommendations

- Before another round of testing NFN (X) for ASW applications, it is necessary to develop viable plans for fusing this information with existing ASW information.
- A study is needed, followed by system development, for how the combined information will be coherently displayed.

JFI #1 - ADOCS Provides Improved Fires Situational Awareness

- ADOCS use demonstrated for TST management and to track engagement progress

- Deconfliction of Fires and fratricide avoidance were improved.

- GCCS-M / simulation interface issues prevented a full test of ADOCS use.
    - Cannot evaluate across-the-board improvement to Fires SA.
    - Cannot differentiate situations for which this system does/does not improve SA.

- DTL display and IWS chat were used in lieu of ADOCS graphical displays.

- It is necessary to:
    - Conduct tests of ADOCS use for situational awareness across a broad TST spectrum of users and situation.
    - Provide more individual and unit training to maximize ADOCS contributions.
    - Determine if modifications to graphical displays are needed.

Joint Fires Initiative #1

The JTF and components were able to manage TSTs and track progress across the full engagement cycle using ADOCS. The system provided an understanding of the overall joint TST operation and improved confidence in Fires decision-making. Using the system to visualize the operation aided in deconfliction of fires and the avoidance of fratricide.

Applicability: There were situations in the experiment where interface issues between GCCS-M and the simulation prevented a full test of ADOCS use for situational awareness. As a result, it is not possible to use the results of this experiment to state an across-the-board improvement or to differentiate those situations for which this system does or does not improve situational awareness.

Graphical displays were not used as the primary means for situational awareness. For example, in the Maritime Operations Center decisions were being made primarily from the DTL display and IWS chat. It is not known if this is because of a deficiency in the displays, greater familiarity with chat, some affinity for chat's use, training insufficiencies, etc. This uncertainty indicates the need to learn more about this use of ADOCS.

Recommendations

- Conduct tests of ADOCS use for situational awareness across a broad TST spectrum.
- Provide more individual and unit training in order to maximize the contributions of ADOCS.
- Determine if modifications to graphical displays are needed.

JFI #2 - DTL Manager Provides Cross-Component Fires Coordination, TTP Problems Exist

- DTL Manager was a successful cross-component coordination tool evidenced by:
    - Number of targets engaged
    - Components contributed to a usually complete and consistent display
- Departures from established TTP occurred:
    - Targets were passed from nominators with no indication of inability to engage.
    - MSN block was changed from white to yellow, an undefined action.
    - These departures can interfere with coordination.
- It is necessary to:
    - Provide better ADOCS TTP training for operators.
    - Determine if current TTP are adequate for all TST situations.

<u>Joint Fires Initiative #2</u>

The DTL manager was a successful cross-component coordination tool. Evidence is the number of targets engaged and the degree to which all components contributed to a usually complete and consistent DTL manager display. However, departures from established TTP, which can interfere with coordination, were observed.

TTP departure examples:

- Targets were passed from nominators who had not indicated an inability to engage.
- The MSN block was, at times, changed from white to yellow, an undefined action.

Recommendations

- Provide better ADOCS TTP training for operators.
- Determine if current TTP are adequate for all TST situations.

JFI #3 - 33 Minute Median Interval For ADOCCS Target Prosecution

- Interval is the median elapsed time from receipt of a target nomination in ADOCS until weapon firing.

- The elapsed time includes the median time delays for the following processes:
  - Nomination receipt to mission passed 15 min
  - Mission passed to coordination block green 1 min
  - Block green to execution intent 2 min
  - Execution intent to weapon fire 15 min

- Interval may not include mensuration.
  - Nominating component was responsible for mensuration, and may have done this before target nomination was received in ADOCS.

Joint Fires Initiative #3

This is the time elapsed from receipt of a target nomination in ADOCS until weapon firing.

This interval does not necessarily include target mensuration time. The nominating component was responsible for mensuration and may have done this before the target nomination was received in ADOCS.

Recommendation: None

NFN (X) #1 - Fully Autonomous NFN (X) Engagements Not Possible

- Autonomous TST engagements were not possible because:
    - The JFMCC MOC maintained TST approval.
    - MOC maintained TST platform assignment control.
    - TST system architecture required all mensuration requests to pass through a single DTMS workstation.

- TST CONOPS and system architecture must permit autonomous engagements.
    - As a fall back position in the face of a centralized system or communications failures
    - To improve chances of successfully engaging short dwell time TSTs.

- Recommend configuring the system so that the target nominator and LAWS can send:
    - Target nominations
    - Associated imagery
    - Mensuration requests directly to the mensuration workstation

Naval Fires Network-Experimental #1

The TST CONOPS and system architecture must permit autonomous engagements both as a fall back position in the face of a centralized system or communications failures and to improve the chances of successfully engaging short dwell time TSTs.

Causes: Autonomous TST engagements were not possible because the JFMCC MOC maintained approval and platform assignment control of TSTs and because of the TST system architecture, which required all mensuration requests to pass through a single DTMS workstation. Both system and process changes are required to enable autonomous engagement with NFN (X).

Recommendation

- Configure the NFN (X) system so that target nominations, with associated imagery, and mensuration requests can be sent directly from the target nominator and LAWS, respectively, to the mensuration workstation.

NFN (X) #2 – Diminished LAWS Utility As TST Management Tool

- LAWS Manager was populated with additional, non-TST targets in this experiment, reducing attention to TSTs:
  - Ship-self-defense
  - Mine
  - Submarine
  - Test targets
  - ATO and call for fire missions

- Some TST targets were passed to other components and their actions and resultant engagements were not reported in LAWS.

- System and TTP recommendations:
  - Restrict the Fires Manager to TSTs
  - Create LAWS Managers for other classes of targets
  - Automatic status change updates in the LAWS Fires Manager
  - Establish procedures for target accountability.

Naval Fires Network-Experimental #2

One of the principal uses of LAWS is as a Fires manager for TSTs. Past experiments have concentrated on this use. This use was expanded in FBE-J. The result was diminished utility for TST management.

Situation: In this experiment, the manager was also populated with ship-self-defense, mine, submarine, test targets, and air tasking order (ATO) and call-for-fire missions.

Some TST targets were passed to other components, and their actions and resultant engagements were not reported in LAWS.

Causes: Several causes for this result are possible:

- Lack of personnel for the additional workload
- Display confusion with the additional objects
- Lack of training for the expanded usage

Which, or what combination, of these effects is causal is not known. Rather than undertake to determine causes, the recommendation at this time is to correct the immediate problem.

Recommendations

- Restrict the Fires manager to TSTs and create LAWS managers for other classes of targets.
- When TSTs are passed to other components for execution, and the ADOCS DTL is updated to reflect engagement actions, have these status changes automatically update the LAWS Fires manager.
- Establish procedures for target accountability. The action or request originator must be responsible for ensuring his action or request was received at the target workstation. This is ideally done automatically.

NFN (X) #3 - Geo-Refinement TTP Development Needed

- The geo-refinement process must be a function of target type:
  - Mensurate short dwell-time targets immediately, prior to weapon-target pairing.
  - For longer dwell time targets, request mensuration after weapon-target pairing.
- Current process difficulties:
  - TST target nominations were almost always received without any indication of the accuracy of the reported target location.
  - Geo-refinement validation increased the median processing time from 10 to 29 minutes.
  - The target location accuracy provided was unrelated to the requested accuracy.
  - All requests to pass through the DTMS, a single point of failure.
- TTP are needed that address directly these processing difficulties.

Naval Fires Network-Experimental #3

For short dwell-time targets, time is of the essence and targets must be mensurated immediately, prior to weapon-target pairing. A risk in this approach is that target mensuration will not be required and the mensuration effort will be wasted. For longer dwell time targets, mensuration should not be requested until after weapon-target pairing so as to determine whether target geo-refinement is required.

Factors contributing to process difficulties:

- TST target nominations were almost always received without any indication of the accuracy of the reported target location.
- FBE-J introduced a workstation (DTMS) into the geo-refinement process and a geo-refinement validation process that necessitated message exchange between LAWS and DTMS. As a result, it required a median of 29 minutes between a LAWS request for mensuration and receipt of the mensuration result, compared to a median of less than 10 minutes to obtain the geo-refined target position at the geo-refinement workstation. Data show that the validation process made no contribution to the geo-refinement process, since the provided target location accuracy was unrelated to the requested accuracy.
- Architecture required all requests to pass through the DTMS, making it a single point of failure.

Recommendations

- Geo-refinement TTP should depend on the dwell time of the TST.
- For high priority, short dwell time targets (TCT), mensuration of the target should begin immediately, even if the geo-refinement might ultimately prove unnecessary by virtue of the weapon-target pairing decision.
- For non-TCTs, the original target nomination needs to contain an estimate of the accuracy of the reported target location. Without this, a reasoned determination of the need for further geo-refinement subsequent to weapon-target pairing cannot be made.
- To permit an informed decision on the requirement for a geo-refined target position, target nominations should be required to contain an estimate of the accuracy of the reported target position.
- Eliminate the validation procedure.
- Reconfigure so that LAWS can send geo-refinement requests directly to a mensuration workstation.

NFN (X) #4 - Median Time, TST nomination To Weapon Release= 60 min

- Represents the median time from receipt of GISRC nomination in LAWS to weapon release.

- Median times of included processes are:
    - Generate geo-refinement request 6 min
    - Geo-refinement production 29 min
    - Weapon-Target pairing 5 min
    - Ready to fire decision 6 min
    - Approval to fire 4 min
    - Time to fire 10 min

- TST timelines include a JFMCC decision/evaluation interval.

<u>Naval Fires Network-Experimental #4</u>

This is the elapsed time from receipt of a GISRC nomination in LAWS to weapon release.

Causes

- The geo-refinement interval (29 min) was lengthened compared to previous experiments due to the validation process.
- Autonomous TST engagements were not permitted; therefore all TST timelines include a JFMCC decision/evaluation interval.

Recommendation: None

ISR #1 - ISR Management Improved; Shortfalls Remain

- The ISR Ops Cell in the MOC was effective in dynamic retasking of ISR assets.

- Deficiencies:
  - No established process to assess sensor re-tasking effects.
  - No confirmation of ISR coverage of the area of operations.

- To provide dedicated cradle-to-grave TST ISR management, studies are need to:
  - Determine required manning levels.
  - Develop a graphic display system to illustrate synchronized ISR planning.
  - Develop TTP emphasis on re-tasking and dynamic planning.

Intelligence, Surveillance, and Reconnaissance Management #1

The ISR operations cell in the MOC was effective in dynamic re-tasking of ISR assets.

There was not an established process to assess the effects on the deliberate ISR plan when sensors were re-tasked to support TST operations. There was no confirmation that there was "seamless" ISR coverage of the area of operations.

Causes: Apparently tools, TTP, and sufficient personnel are lacking to enable full-spectrum ISR operations. Considerable investigation is needed to understand requirements.

Recommendations

- Determine manning levels required to provide dedicated cradle-to-grave TST ISR management.
- Develop a graphic display system to illustrate synchronized ISR planning.
- Develop TTP for ISR management with emphasis on re-tasking and dynamic planning.

ISR #2 - TES-N Can Be An Effective ISR Tool; Further Development Needed

- TES-N excelled at display of near-real-time location of Red assets.

- Limitations:
    - TES-N/NFN lacks effective means for integration with other systems.
    - Lack of direct downlink operations limited NFN system TST capability.
    - NFN needs faster, more reliable communications to deal effectively with TSTs.
    - There was no TTP for sharing GCCS-M and TES-N information.

- Studies should be undertaken to:
    - Develop a means for providing appropriate, near real-time TES-N information to the fires cell.
    - Develop a means for displaying TES-N information in GCCS-M.
    - Develop TTP for use of TES-N information in the TST process.

<u>Intelligence, Surveillance, and Reconnaissance Management #2</u>

TES-N excelled at display of near-real-time location of Red assets for decision makers. The system can be effective but several issues need to be resolved.

Technical improvements are needed in the following:

- TES-N/NFN lacks effective means for integration with other systems.
- Lack of direct downlink operations limited NFN system's TST capability.
- NFN systems need faster, more reliable communications to deal effectively with TSTs.
- There was no established operational context for when or how to share GCCS-M and TES-N information.

Recommendations

- Develop a means for providing appropriate, near real-time, TES-N information to the Fires cell.
- Develop a means for displaying TES-N information in GCCS-M.
- Develop TTP for use of TES-N information in the TST process.

ISR #3 - Time Critical Targets Do Not Appear In The COP

- Most Time Critical Targets in FBE-J were detected or confirmed using:
  - Imagery from satellite
  - Air reconnaissance operations
  - Unmanned air reconnaissance operations

- Target nomination process currently excludes sending TCT tracks to GCCS-M.
  - Applies only to tracks resulting from imagery

- Tracks sent to C2PC from DTMS are also not forwarded to GCCS-M 3.X.

- DTMS has current requirement to send tracks from imagery to the COP.
  - Interface will not be fully implemented until DTMS version 4 (companion with GCCS-M 4.X).

Intelligence, Surveillance, and Reconnaissance Management #3

Most time critical targets in FBE-J were detected or confirmed using imagery from satellite, air, or unmanned air reconnaissance operations. The process for nominating these targets for strike currently excludes sending such TCT tracks to GCCS-M.

Applicability: This result applies only to tracks resulting from imagery. DTMS has the requirement to send tracks from imagery to the COP. This interface will not be fully implemented until DTMS version 4 (companion with GCCS-M 4.X) is released. Tracks sent to C2PC from DTMS are also not forwarded to GCCS-M 3.X.

Recommendation

- Continue with implementation of requirement already in place.

ISR #4 - MIUGS Terminal Was Able To Send Track Data To GCCS-M; Reported Results Inconsistent

- MIUGS inputs can be functionally used to identify TCTs to augment the COP.

- Data sent by MIUGS was not reliable for precision strike.
    - MIUGS sent the wrong coordinates; tracks did not match actual target location.

- There were large inconsistencies in reported MIUGS performance:
    - Reports that everything worked perfectly
    - Reports of substantial tracking errors
    - Reports of errors in passing of data from one system to another

- A review of MIUGS results is needed to determine actual versus supposed performance.

Intelligence, Surveillance, and Reconnaissance Management #4

The Micro-Internetted Unmanned Ground System (MIUGS) provides information to augment the COP. GISR-C was requested by MIUGS to nominate a MIUGS target from GCCS-M to LAWS. The exercise demonstrated that MIUGS inputs could be functionally used for TCS.

Limitations

- MIUGS sent the wrong coordinates to the system. Tracks sent to the system did not match the actual target location. Data sent by MIUGS could not be relied on for precision strike.
- There were large inconsistencies between reported MIUGS performance, ranging from everything worked perfectly to there being substantial errors in tracking and the passing of data from one system to another.

Recommendation

- A review of MIUGS results is needed to determine actual versus supposed performance.

MIW #1 - Engagement Of Mine Targets In LAWS Possible;
Process Development Needed

- Feeding mine contacts into LAWS and engagement through that system is workable:
    - Procedures need to be simplified.
    - TTP needed.

- Treat mine nominations as another target within LAWS:
    - Mine nomination weapon-target paired
    - Engagement conducted within mine nomination entry in LAWS Fires manager.

- Test of the concept is needed using a combination of live mine and other targets.

Mine Warfare #1

The concept of feeding mine contacts into LAWS and engaging them through that system appears workable. Procedures need to be simplified and codified. Mine nominations should be treated like other target nominations within LAWS, i.e., mine nomination weapon-target paired and the engagement conducted within the mine nomination entry in the LAWS Fires manager. This recommendation conflicts to some degree with NFN (X) #2, where a separate manager for non-Fires targets was recommended.

Applicability: The engagement problems were exacerbated and, to a degree caused, by problems with the FASM methodology and simulation. Thus, definitive results on this application are not yet available.

Recommendations

- Develop a methodology that handles mines the same as other targets within LAWS.
- Test the concept with a combination of live mine and other targets.

MIW #2– HSV Appears to be Excellent Platform for Supporting MIW

- Advantages include:
  - High speed
  - Shallow draft
  - Large cargo volume to provide future hotel services for support of RAVs and mission and maintenance crews

- Disadvantages and risks include:
  - Potential vulnerability of the HSV to hostile fire
  - Loss of one HSV with large number of RAVs (est. 25 to 30) could risk entire MIW mission success and/or timeline if additional resources are not readily available
  - MIW may have to compete with other missions for the use of the HSV

- Studies are needed to mature the CONOPS for HSV support of MIW
  - Determine the appropriate number and distribution of MIW assets on HSVs
  - Assess requirement for redundant back-up operational databases and MIWC SA in case of losses
  - Estimate likelihood that competition for HSV resources will impact on MIW mission success

<u>Mine Warfare (MIW) #2</u>

The HSV appears to be an excellent platform for supporting the MIWC and MCM.
Advantages include:

- High speed to area of operations and while conducting various MIW missions
- Shallow draft will allow operations in relatively shallow water
- Large cargo volume can provide ample workspace and support areas for supporting future RAVs and their operational mission and maintenance crews

Disadvantages and risks include:

- Potential vulnerability of the HSV to hostile fire due to its aluminum composition and small crew
- Loss of one HSV with large number of RAVs (est. 25 to 30) could risk the entire MIW mission success and/or timeline if additional resources are not readily available
- Under the concept of rapid reconfiguration for HSVs, MIW may be competing with other missions for the use of the HSV

Recommendations

Undertake studies to mature the CONOPS for HSV support of MIW, including

- Determine the appropriate number and overall distribution of MIW assets on HSVs
- Assess the requirement for redundant back-up operational databases and MIWC SA in case of loss
- Likelihood that competition for HSV resources will impact on MIW mission success

MIW #3 – JFMCC is Challenged in Management of MIW

- MIW missions are longer than typical JFMCC MSR missions and may not be suitably managed within the overall JFMCC process at present. .
- The ATO tasking vehicles are not optimal for MIW missions
- Direct tasking of platforms in MIW is preferable to the indirect tasking associated with MSRs
- Present reduction of data and the development of tasking is unnecessarily manpower intensive

- Studies are needed to:
  - Develop a more workable interaction dynamic between JFMCC and MIW
  - Evaluate the impact of lengthy MIW missions on shared resources and vice versa
  - Evaluate the potential for manpower reductions with automation of data reduction and tasking in MIW

Mine Warfare (MIW) #3

JFMCC management of MIW is a challenge that presently strains players on all sides. There are several reasons for this:

- MIW missions are longer than typical JFMCC missions and may not be suitably managed within the overall JFMCC process at present. This is a resource allocation issue, as the JFMCC staff may reallocate HSVs and other resources after the expiration of the 24-hour MTO/ATO, but MIW missions initiated during the valid period may still be on-going, due to the length of some MIW missions.
- The ATO tasking vehicles are not optimal for MIW missions
- Direct tasking of platforms in MIW is preferable to the indirect tasking associated with MSRs
- Present reduction of data and the development of tasking is unnecessarily manpower intensive

Recommendations

Conduct studies to

- Develop a more workable interaction dynamic between JFMCC and MIW
- Evaluate the impact of lengthy MIW missions on shared resources
- Evaluate the potential for manpower reductions achievable with automation of data reduction and tasking in MIW

MIW #4 --- RAVs are the Future in MIW

- Remote Autonomous Vehicles (RAVs) offer advantages in speed, effectiveness, and covertness. HSVs will be able to host 25 to 30 systems per HSV

- Potential issues
    - Data should be retrieved in or near real-time
    - More complicated management and control
    - Present inability to operate in kelp requires additional engineering
    - Launching and retrieval should be done at high speeds

- Studies are needed to:
    - Assess methods to optimize the receipt and management of data
    - Develop reliable ways to control multiple systems operating concurrently
    - Re-engineer systems to reduce or eliminate their present vulnerability to kelp
    - Investigate alternative approaches to launching and retrieving RAVs at high speed

<u>Mine Warfare (MIW) #4</u>

Remote Autonomous Vehicles (RAVs) offer tremendous potential for rapid, effective, and covert MIW operations to ensure assured access to hostile territory. Future HSVs could host 25 to 30 of these RAVs per HSV. The management of a multiplicity of these systems, possibly among several HSVs will be far more complex than anything experienced to date in MIW or demonstrated in FBE-J. There was no stressing of the RAV systems in FBE-J, so no assessment can be made of problems or issues that will arise when one HSV attempts to manage, control, and exploit a number of these systems.

Potential issues include:

- Data should be retrievable in or near real-time so as not to delay follow-on planning actions
- More complicated management and control can be expected
- The present inability to operate in kelp requires additional engineering to RAVs to reduce potential risks and mission impairment
- Launching and retrieval of RAVs should be accomplished at reasonably high speeds

Recommendations

- Assess methods to optimize the receipt and management of data
- Develop reliable ways to control and minimize potential interference of multiple systems operating concurrently
- Re-engineer systems to reduce or eliminate their present vulnerability to kelp
- Investigate alternative approaches to launching and retrieving RAVs at high speed

IO #1 - Hardened Client Defeated Red-Team Attack.

- Hardened client successfully deflected direct Red team attack using:
  - Layer 1, e-mail wrappers blocked behavior contained in e-mail attachment macros.
  - Layer 2, ADF prevented outbound FTP as well as outbound root shell jump point.

- ADF was an effective defensive technology scalable to full operational deployment, however:
  - ADF equipped machines easily detected using basic scans.
  - Partial ADF coverage permits quick identification of unequipped computers and an attack from that point.

- Configuration management issues associated with all machines containing ADF cards:
  - Scalability; ability to manage 1000+ systems
  - Legacy and custom software applications complications
  - Correlation of audits across policy servers for incident handling

- A policy for ADF equipage as a function of network and machine is needed.

<u>Information Operations #1</u>

A Hardened Client successfully deflected direct Red team attacks through operating system (OS) wrappers and autonomic distributed firewall (ADF) configuration. The Red team was not successful in achieving the goal of disrupting time critical targeting during attack periods.

<u>Defense systems</u>

- First layer: safe e-mail wrappers blocked harmful behavior contained in e-mail attachment macros sent by Red team participants.
- Second layer: ADF prevented outbound file transfer protocol (FTP) as well as outbound root shell jump point. ADF demonstrated an effective defensive technology that can be scaled to full operational deployment.

<u>Limitations</u>

- ADF equipped machines were easily detected using basic scans. A network with only partial ADF coverage would permit quick identification of unequipped computers and an attack from that point.
- Configuration management issues associated with incorporating ADF cards in all network machines include; scalability, the ability of one person to manage 1000+ systems, legacy and custom software applications complications, and the correlation of audits across policy servers that would make incident handling difficult.

Recommendation

- Develop a policy for ADF equipage as a function of network and machine.

IO #2 - E-Strike Munitions Extensively Used.

- Kinetic and non-kinetic IO Fires were integrated into TST operations.
- Control of IO weapons by the operational commander is critical for synchronizing kinetic and non-kinetic warfare.
- E-strike weapons not being in TBMCS had a negative impact on weapon use planning.

Information Operations #2

Operational commanders required the capability to launch theater-level, information attacks when appropriate. The offensive information operations experiment conducted during FBE-J centered on utilizing E-Strike munitions in support of time critical strike scenarios. As FBE-J progressed, kinetic and non-kinetic IO Fires were integrated into TST operations.

Comments

- Placing control of information operation weapons with the operational commander is critical for synchronizing kinetic and non-kinetic warfare.
- E-strike weapons were not loaded in TBMCS. This had a negative impact on weapon use in the Strike Warfare Commander (STWC) planning effort (30-50 percent of planned missions came from ATOs).

Recommendations

- Operational commanders should control IO weapons systems.
- TBMCS should contain E-strike weapons.

NF/KM #1 - KMO Achieved Technical But Not Organizational Objectives

- Knowledge management operations were a technical success:
  - Decision support information was timely and accurate
  - Reduced uncertainty
  - Increased situational awareness
  - Shortened decision cycles.

- Organizational/process inadequacies:
  - Lack of high-level gleaning of information
  - Information not processed into knowledge needed, at the right time and place, by critical decision makers.

- Indiscriminate distribution threatens information overload.
  - Shift focus to providing relevant information, correlated to task.

- Required development:
  - Shift of focus from technical to process solutions.
  - Determine required information content as a function of task and situation.
  - System that filters information into relevant blocks with targeted dissemination.

<u>Netted Force / Knowledge Management #1</u>

Decision support information was timely and accurate. The knowledge management organization (KMO) is effective in reducing uncertainty, increasing situational awareness, decreasing information overload, and shortening decision cycles. An effective technical process was responsible for information reaching critical decision-makers. There was not an active and high-level gleaning of information and processing of that information into knowledge needed, at the right time and place, by critical decision makers.

Implications: There exists the possibility of producing accurate information, disseminating it widely, and insuring all recipients receive the same information, but having the result be information overload because there is not a focus on providing relevant information to those performing specific tasks.

Information relevancy, and KMO processes to identify and manage information and then keep that information relevant to critical decision-makers, would require different organizational and information processes than those present in the experiment.

Causes: There is a continuing tendency to focus on technical solutions to information dissemination at the expense of process. The contribution of KMO to information management was secondary to technical aspects of information communications, and its use did not achieve high-level or strategic objectives envisioned.

Recommendations

- Determine required information content as a function of task and situation.
- Develop a system that filters information into relevant blocks, with attendant targeted dissemination.

NF/KM #2 - KMO Stressed Communication, Computing, Display Resources

- KMO stressed available resources. TTP are needed to optimize:
    - Bandwidth allocation
    - Server utilization
    - Application utilization
    - Communication utilization

- Studies are needed to:
    - Determine expected utilization of KMO systems as a function of operational situation.
    - Determine KMO resources required for maximum load.
    - Develop a services prioritization scheme for KMO utilization.

Netted Force / Knowledge Management #2

The need for the KMO functionality was demonstrated. However, KMO put a significant load on available bandwidth that was not taken into account when making operational bandwidth allocation decisions.

Utilization of the servers, applications, and communication processes within the infrastructure was not optimized. More effective and detailed TTP in this area are required if the potential benefits from KMO are to be realized.

Recommendations

- Determine expected utilization of KMO systems as a function of operational situation.
- Develop a services prioritization scheme for KMO utilization.
- Determine KMO resources required for maximum load.

CIE #1 - Collaborative Information Environment Technical Objectives Achieved

- SPPS integrated critical systems through a portal and application framework.
    - Planning and execution timelines reduced
    - More efficient integration of information and communications
    - Enabled flattened organizational hierarchies and decision-making

- JFMCC components integration accomplished
    - Standardized applications within the portal framework
    - Information present within a browser-based application
    - Visibility in and across cells from any network access point

- Needed developments:
    - Workflow automation applications
    - Compatibility of information and communication systems with portal interfaces
    - Improved search and retrieval functions
    - Reduction in the number of environments
    - TTP and training programs for CIE use

Collaborative Information Environment #1

The collaborative information environment (CIE) was designed to: reduce planning and execution timelines; enhance organizational effectiveness for distributed operations; flatten organizational hierarchies and decision-making; enable self-synchronization; and integrate ADOCS/LAWS for situational awareness in distributed operations. The overall objective was to enable rapid decisive operations (RDO) through more efficient integration of information and communications. Technological aspects of CIE were achieved with impressive utilization of cutting-edge technologies. SharePoint Portal Service (SPPS) integrated critical systems through a portal and application framework that effectively reduced planning and execution timelines.

Portal/browser structure: The integration of JFMCC components was accomplished through standardized applications within the portal framework. Most component information was present within a browser-based application that could be viewed in a cell and across cells, from any network access point. The common relevant operational picture (CROP), secondary information relevant to the COP, was available within the web site and on pages of SPPS, where users could browse or search for information.

<u>Limitations</u>

- Workflow automation routines that would send pertinent information to appropriate personnel for action and provide automated routing through the chain of command have not yet been integrated into the process.
- SPPS provided an integrated, customizable interface into pertinent information, but not all information or communication systems were compatible with portal interfaces or display technologies.
- Search and retrieval functions appeared operational but not comprehensive or well used.
- IWS and IRC collectively provided means for communication and collaboration, albeit the requirement that two distinct systems be in operation was a significant disadvantage.

Recommendations

- Continue development of CIE with increased focus on reduction in number of required environments.
- Develop TTP and training programs, and institute them for CIE use.

JTAMD #1 - Navy Forces Provide Significant Contributions To TAMD/TBMD

- Navy unique capabilities provide a JTAMD force multiplier:
    - Protected critical assets on the DAL
    - Augmented PATRIOT units
    - Provided the lower tier component for THAAD
    - Projected missile defense over amphibious landings
    - Provided a key complement to Army Air Defense Artillery

- Critical support provided for:
    - Terminal phase TBMD
    - Mid-course TBMD

<u>Joint Theater Anti-Missile Defense #1</u>

The inherent mobility and flexibility of Naval forces constituted a unique joint capability and a force multiplier during the experiment. Navy ships protected critical assets on the Defended Assets List (DAL), augmented Patriot units, provided the lower tier component for Theater Phase High Altitude Defense (THAAD) system, and projected missile defense over amphibious landings ashore.

Ships provided a key complement to Army Air Defense Artillery (ADA) surging to meet anticipated threats or to respond to other operational changes, while THAAD and PATRIOT batteries focused on the defense of fixed critical assets.

<u>Applicability</u>

For the situations tested during the experiment, Navy forces appeared especially valuable for the following:

- Terminal Phase TBMD: A robust terminal phase TBMD capability was critical to joint missile defense. Although extensive Army Air Defense Artillery (ADA) forces were in theater, Navy forces played a critical role defending designated critical assets either alone or in conjunction with sea-based mid-course defense (SMD), THAAD and PATRIOT.
- Mid-Course TBMD: The contingency SMD capability was critical to achieving the Joint Task Force Commander’s (JTFC’s) desired probability of negation. Against longer-range threats the extensive defended footprint provided an upper tier component of a two-tiered defense for a large number of critical assets.

Recommendations: None

JTAMD #2 – Current Limitations To Navy Joint TAMD/TBMD

- Limitations experienced:
  - ADC/RADC was never fully integrated into Air Operations Center (AOC).
  - Unsuccessful integration of Army and Navy missile defense forces covering common critical assets.
  - Limited ability to handle the threat posed by large numbers of relatively unsophisticated short-range missiles and artillery rockets.
  - Weapons systems models in decision aids did not yield common solutions.

- Required developments:
  - Common TTP and joint doctrine for roles, missions, and responsibilities between functional component commanders and their subordinate commanders.
  - Tactical decision aid models for short-range missile and artillery defense.
  - Cross-service planning and tactical decision aids.
  - Develop joint doctrine for cross-service JTAMD.

Joint Theater Anti-Missile Defense #2

The Air Defense Commander/Regional Air Defense Commander (ADC/RADC) was never fully integrated into AOC battle rhythm, and the organizational relationship between the Joint Forces Air Component Commander/Area Air Defense Commander (JFACC/AADC) and the ADC/RADC remained ambiguous. The absence of joint doctrine defining the role of a RADC and the lack of direct communication between the JFACC/AADC and the RADC most likely contributed to the difficulty.

Attempts to develop coordinated engagement procedures when both Army and Navy missile defense forces covered common critical assets were unsuccessful. Doctrinal and technical differences between Army firing units and Navy ships formed a barrier and did not allow coordination beyond spatial deconfliction ("engagement zones"). Without changes to existing doctrine, systems, and operational concepts, dynamic battlespace coordination including integrated engagements will not be possible.

Though it received less high-level attention than longer-range missiles, the threat posed by large numbers of relatively unsophisticated short-range missiles (<300 km) and artillery rockets was a significant factor in operational planning and caught many planners by surprise. Coordination between the DAADC and the maritime ADC/RADC was hindered, as existing planning tools did not include models for these threats and the numbers present required intense considerations of interceptor inventory. The widespread distribution of these types of weapons warrants increased consideration in operational planning.

Collaboration was hindered when weapons system decision aid models did not yield common solutions, even with identical data input. For distributed collaboration to be effective, all participants must have a common understanding of the capabilities and limitations of the individual systems.

Recommendations

- Develop common TTP and joint doctrine that defines roles, missions, and responsibilities between functional component commanders and their subordinate commanders.
- Develop models that can be used as tactical decision aids for short-range missile and artillery defense.
- Develop models and decision aids that yield identical solutions when given the same inputs and implement their use across services.
- Develop joint doctrine for cross-service JTAMD.

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3.2 Initiatives' Context

Data and information are obtained from an experiment under a set of conditions. Analysis results have known validity only for those conditions, their range of applicability. Specifying its range of applicability is as important as the result. We refer to "context" as the set of conditions that existed during the experiment. There is a hierarchy of conditions:

- General conditions - are the overall setting under which the experiment was conducted. This was provided in the former Section of this report.
- Initiative conditions - are special conditions that were set up to meet the objectives of an initiative.
- Results conditions - are special conditions that are pertinent to understanding a particular result. For example, an initiative condition could be use of short-dwell-time transporter / erector / launchers (TELs) for Fires capabilities testing. A particular result condition could be three TELs per 15 minutes, causing TCT prosecution to break down. Results conditions, if needed, are reported along with the principal results in the first Section of this report.

From a carefully designed experiment it may be possible to extract cause-and-effect. This can provide a model of the behaviors of systems and the processes within which the systems operate. Cause-and effect relations allow extending results to conditions other than those under which they were obtained. Two related conditions are necessary if an experiment is to produce cause-and-effect understanding: control of variables and change. Knowledge of variable states is necessary, and control of variables is preferred, in order to produce data for quantitative analyses. This is especially important for complicated experiments such as FBEs.

One cannot observe the effects produced by a variable without changing it. All cause-and-effect relationships are "if this influence is applied, that happens". A force/influence being applied is a change in that variable, and the response is a change in state of the system of interest. A well-designed experiment is one that controls and changes a variable so as to observe a desired effect, under desired conditions. In experimental situations as complicated as FBEs, it is not always possible to control variables. Whether or not control can be exercised, it is necessary that everything that influences a result be recorded.

An assessment of "experiment quality" is also needed. This is an expression of how well the experiment was designed to meet its stated objectives. FBEs consist essentially of many experiments within an overarching exercise/experiment. Initiatives are individual experiments. Because there is variability in how well individual initiatives are designed, an expression of experiment quality is needed for each.

The next part of this Section will be a description of the important facets of experiment quality. This is followed by context for each of the initiatives.

<u>Experiment Quality Condition</u>

Figure 3-1 illustrates experiment design principles for a particular initiative considering two parameters (A and B) that could influence the results. The initiative could be, for example, MIW, with parameter A representing target density, and parameter B the transit and operational speed of a mine clearance vessel. These are only two of the many possible parameters that establish experiment conditions. We use speed and target density to describe the meanings of various parts of the figure.

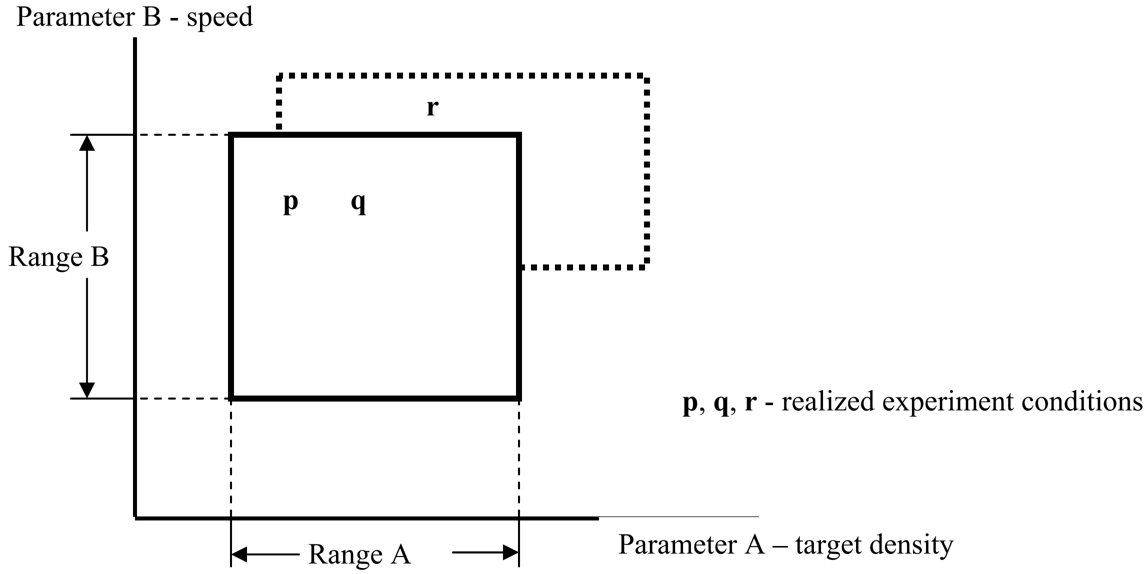

Figure 3-1. Representative Ranges of Parameters within an Experiment (notional)

The notional experiment is to examine employment of an HSV as a mine warfare platform and determine its effectiveness for various speeds as a function of mine density.

The solid box and ranges are conditions for which experimentation results are needed to satisfy the initiative objectives. Parameter B is vessel speed (10 to 40 knots), and parameter A is target density (10 to 30 per square kilometer).

The dashed box depicts the ranges of conditions under which the experiment was actually conducted (25 to 55 knots, 15 to 45 per square kilometer).

Points p, q, and r are conditions existing when data were obtained (p is operating at 35 knots against 15 targets per square kilometer, etc). Experiment data are obtained at a particular time, under particular conditions. Point p could be early in the experiment, q later, and r towards the end. Changes in parameters A and B with time could be by design or by natural experiment evolution.

The positions of the dashed box and conditions points p, q, and r show that the experiment was carried out only for high vessel speeds (or that data were collected or analysis done only for high speeds). Thus, the full objectives of the initiative (a wider range of speeds) were not met.

Several observations can be made about the conditions points:

- The difference in points p and q are due to a change in only target density. This may represent good experiment control, holding speed fixed.
- The change in conditions from q to r is due to changes in both density and speed, which makes cause-and-effect difficult to determine. If an experiment purpose is to determine reasons for different results produced between conditions q and r, the experiment is poorly designed because influences due to changing both density and speed are mixed. One also needs data for density held fixed and speed varied, a point vertically above q.
- A conditions point may represent several observations or results. If this is the case, statistical analysis can be performed for that set of results.

- It is possible (likely) that conditions are not exactly the same for a set of results. The condition points would then cover a small area (or line if only one parameter varies). Whether or not such results are treated as having the same conditions is a matter of initiative definition.

Subjective opinions (information rather than data) about experiment performance will often apply over a range of experiment conditions, perhaps the whole or some portion of the dashed box.

If there is no overlap between the solid and dashed boxes, either or both experiment design or execution is poor. The objectives of the initiative will not be met. A statement of how well the two boxes overlap, the "quality" of the experiment, is part of initiative context. There are no quantitative measures for "quality" of experiment design or execution. Rather, a subjective statement is made about "quality" and an explanation for the reason(s) included. Experiment Quality is stated on a sliding scale:
Very low Low Marginal Good Very good

The fact that condition r is outside the design box is not necessarily an experiment flaw, however. It may actually be beneficial because it can provide results by the process of discovery.

The variation of conditions with time, represented by p, q, and r being different, provide the opportunity to observe results changing in response to parameter changes. This is one potential source of information for determining cause-and effect. Especially unnerving, and of marginal use, are observed changes in results that cannot be associated with parameter changes. Such results represent poor experiment design or execution.

Overarching Context

New initiatives within the Department of Defense focus largely on three things:

- Network-centric operations – wherein critical information is accessible throughout the force.
- Transformation – integrating new technology and innovative operations fostered by new technology into military operations to improve agility, effectiveness, and efficiency.
- Joint operations – the ability for the military services to operate together seamlessly.

The initial experiment plan for FBE-J, which was the foundation for subsequent planning, mentioned net-centric, largely ignored transformation, and focused on joint capabilities. From subsequent plans through actual execution of Juliet, however, there was a distinct metamorphosis toward emphasizing and executing the initiatives toward:

- More traditional and narrowly scoped military objectives, and
- There was no injection of stress into operations execution.

Thus, a sense of transformation was not achieved and critical real-world pressures that typically affect decision-making were absent.

Initiative Context Descriptions

The following provides context for each initiative, and characterizes experiment quality. Any needed conditions or details that are not contained in the general description in Section II are included here.

JFMCC Maritime Planning Process

MPP context is the most difficult to describe of all initiatives. It is an evaluation of the effectiveness of a new process, one for which no definite data nor design conditions could be specified. The initiative was an exploration of what is needed to make the process work, and also one where what was learned was to be included in further development of the MPP as doctrine with included TTP.

A statement of what was to be learned was posed as a question: "Does the JFMCC maritime planning process provide the structure, organization, management, feedback, optimization, and situational awareness to maritime force employment and support the intent of a joint effects tasking order (ETO)?"

The contextual meaning of this question is <u>whether or not the specified attributes exist</u> in the MPP. Clarifying definitions of the attributes are:

- *Structure* – information, knowledge, and decision structure relationships contributing to MPP system performance.
- *Organization* – functional, personnel, and task relationships contributing to MPP system performance.
- *Management* - the MPP operating as a C2 function, providing internal and external synchronization, and managing planning functions.
- *Feedback* - feedback information of different kinds and levels, contributing to organization management and process control at the operational level.
- *Optimization* – merging of battlespace situational awareness and asset planning to produce an optimized plan.
- *Situational Awareness* – presentation of battlespace actions in a COP, within the context of the ETO, providing continual assessment of operational and tactical status.

The following provides specific context for each attribute, followed by an experiment quality condition for the initiative as a whole, with an explanatory statement.

Structure Context; focus on workflow information

- A workflow tool was integrated technically but not into the process.
- Course of analysis tools (e.g., Navy Simulation System) were not integrated.
- InfoWorkSpace (IWS) was integrated into the process.
- Knowledge management provided only web-space maintenance.

Organization Context

- Personnel assignment changes were made between spirals and experiment execution.
- Insufficient training on systems, processes, and relationships was provided.
- Relationships and organization could not be varied to observe effects.
- Personnel and functional relationships, and their contributions, could not be well determined.

Management Context

- Technical interfaces for internal MPP coordination were in place.
- Plan changes were implemented only at Maritime Operations Center.
- Inadequate integration of tools and processes made it difficult to evaluate adequately the MPP as a C2 function.

Feedback Context

- Feedback from and to different levels of organization, process, and command was nearly absent.
- Feedback on changes in battlespace environment was absent or little used.

- The absence or use of feedback means this process could not be observed.

Optimization Context
- Optimization software was not ready for the experiment; hence no results could be obtained.

Situational Awareness
- Briefings were used for shared understanding rather than the COP or distributed knowledge management. Information could not be obtained on use of knowledge systems for the MPP.

MPP Experiment Quality Condition
The quality of the experiment with respect to being able to obtain information that applied directly to stated objectives within the initiative was **very low**. However, if one accepts that a significant part of the reason for this initiative was to determine if the MPP could work and to provide guidance for future developments, the quality was **good** for illuminating difficulties and possible cures.

A significant amount of detailed information emerged about process difficulties and means by which they could be improved, basically through a process of discovery.

Joint Fires
The timely assessment and engagement of time sensitive targets (TSTs) across components poses challenges in establishment of a timely and accurate common operational picture (COP), effective collaboration across components, and timely integration of joint capabilities against the target.

The overarching questions were:

- Does the proposed (experimental) joint targeting (cross component) architecture enable timely engagements of TSTs?
- In what ways does a common toolset within the joint architecture affect the ability of the joint force to conduct effective cross component TST operations?

Timely engagements context
- No means were available to capture the interval between the component identification of the target and the promotion of the target into the automated deep operations coordination system (ADOCS).
- The dynamic target list (DTL) was unstable due to frequent updates.

Contribution of architecture to cross-component engagements context
- Training in the prescribed tactics, techniques, and procedures (TTP) was inadequate.

JFI Experiment Quality Condition
The quality of the experiment with respect to being able to obtain information that applied directly to the stated objectives within the initiative was **good.**

High Speed Vessel (HSV)
The High Speed Vessel initiative, with both real (JOINT VENTURE, HSV-X1, Sea Slice) and simulated vessels, was to be an enabler of MIW and MC02 initiatives. In the FBE, these platforms were to provide the Mine Warfare Commander with a sensor platform and C4I platform. Within the context of MC02, HSVs were to provide the Joint Force Commander with an enhanced ability to accelerate the tempo of operations.

A statement of what was to be learned was posed as a question:

"What additional value added does having a number of high speed, reconfigurable, and multi-mission platforms provide the JFMCC and JFC in a littoral campaign as part of an access mission?"

Specifically the desired added value was to contribute to support to the Mine Warfare Commander in planning and execution of a mine warfare campaign, support to naval special warfare operations, support in a ship-to-objective-maneuver, employment in an interim brigade team redeployment, and logistics support to deployed forces ashore.

Context of HSV Contribution to MIWC Operational Planning and Execution

- ISR management procedures and processes were not in place at multiple levels.
- There was lack of feedback from previous missions.
- There was insufficient familiarity with use of such a vehicle amongst high-level planners so its possible impact on operations and planning was not tested.

Context of support to Naval Special Warfare Operation

- Only whether the ship would physically support Special Operations personnel was tested.

Context for Logistics Support to Deployed Forces Ashore

- There was no "ownership" of the HSV asset because they were managed by placing them in a common pool.

HSV Experiment Quality Condition

This experiment was mainly to introduce the concept of using an HSV. This quality was **good**. The quality of the experiment for testing how to physically use the ship, such as how to reconfigure was also **good**. Determination of the effect on operations was **poor**.

Naval Fires Network--Experimental (NFN(X))

NFN (X) implemented experimental Navy targeting systems and processes that supported joint targeting and Fires requirements across components, up to CJTF and down to tactical Naval Forces through defined CONOPS, TTP, systems architecture, and organization. Navy Fires projected power ashore through the integration of long-range surface, sub-surface, and air delivered Fires.

The overarching questions guiding this initiative were:

- What is the contribution of Naval platforms self-targeted engagements to the TST engagement problem?
- What are the operational planning and employment considerations required for the effective utilization of future power projection platforms in the TST engagement process?
- How successful is the defined TST architecture in engaging asymmetric TST targets?
- How successful were Naval platforms in responding to multi-mission tasking?
- What is the contribution of the mensuration manager to the TST process?
- What will the introduction of a ground COP contribute to the TST process?

Self-targeting context

- Architecture prevented appropriate tests by requiring all target nominations to be centralized via the DTMS.

- TTP also precluded testing by establishing rules of engagement that mandated that the MOC maintain TST authority.

Operational planning and employment context

- Minimal weapon systems discriminators were included to differentiate these new systems from current systems.

Asymmetric target engagement context

- Major asymmetric attacks that were planned for simulation were by small boats in a SWARMEX, which was cancelled due to weather. Other smaller simulation-generated small boat attacks were executed, but did not represent the equivalent intensity of the larger exercise.
- The weapon-target pairing system did not contain conventional arms to use against small boats.

Multi-mission targeting context

- There was minimal, if any, multi-mission targeting undertaken.
- Multi-mission targeting systems (including personnel roles) were not pressured, so that the range of performance for these systems under stress could not be determined.

Mensuration manager context

- The mensuration tasks were not demanding enough to test adequately the system over a range of performance.
- These systems were not tasked in a controlled manner to determine maximum capacity, thus no "management" of the mensuration assets was required.

NFN (X) Experiment Quality Condition

The quality of the NFN (X) initiative of FBE-J with respect to being able to obtain information that applied directly to stated objectives within the initiative was **low**. FBE-J did, however, produce a level of data for the mensuration process that was unprecedented in the history of FBEs. This permitted a detailed examination of the mensuration process and led to recommendations for improvements.

Intelligence, Surveillance, Reconnaissance Management (ISRM)

The Joint ISR concept of operations for MCO2 outlined a network-centric approach conducting joint-force-wide ISR in which all ISR players will be linked by a collaborative command and control ISR (C2ISR) network. The underlying JFCOM hypothesis was that this collaborative linkage of all ISR players would enable coordinated execution of ISR operations that were widely distributed, while at the same time maintaining cohesion, coordination, and unity of effort.

The overarching objective for FBE-J was to examine doctrinal implications and to refine the TTP for joint and maritime C2 and assured access. FBE-J experimented with the convergence of deliberate and dynamic ISR management, in support of joint force and component-specific ISR requirements, within the JFMCC construct.

JFMCC ISR planning context

- The ISR C2 architecture did not include a TST manager to validate targets. Decisions regarding assets allocation were based on operator perspective only.
- TES-N could not create manual contacts due to software problems and TES-N contacts were not viewable on GCCS-M COP display.
- There was no operationally sound interface to link TES-N and DTMS/RRF.

Dynamic ISR management context

- There was no consistent live air picture for correlation of link tracks with the ATO.
- There was no graphic depiction of the synchronized ISR plan.

Distributed UGS and unmanned UAV context

- The unattended ground sensors (UGS) system was not fully tested prior to the experiment.
- Data were not made available from the contractor to establish accuracy of MIUGS tracks.
- Weather (fog) precluded many flight operations for the Predators, which were the last link in the delivery of munitions to targets identified by the UGS. When Predator was available, MIUGS tracks were not transmitted to the STWC, and when the communications systems worked, the UAVs were unavailable.

Multi-platform SIGINT context

- Networked Specific Emitter Identification (SEI) was tested under reasonable battle scenario conditions.

ISRM Experiment Quality Condition

The quality of the experiment for obtaining information that applied directly to stated objectives was **low.** Much was learned which should lead to improved results from subsequent experiments.

Mine Warfare

It is likely over the near-term, that the littoral seas will become increasingly important and challenging for maritime and joint forces to access quickly and safely. New platforms such as high speed vessels (HSVs), and technological advances in sensor capabilities increase the organic MCM capability and present the MIWC with new challenges and opportunities in organization, resource allocations, information management, and C2.

As a first step in dealing with these new realities, the MIW experiment in FBE-J was to examine the application of network-centric warfare concepts and other emerging technologies as they might apply to mine warfare and to determine how they could enhance the efficiency and effectiveness of mine warfare. HSVs were to be assessed as MCM sensor support and management platforms, and an examination was to be done of the integration of MIW with NFN, and the MIW use of the common undersea picture (CUP).

HSVs as MCM sensor support and management context

- HSV operations were independent of JFMCC requirements and decisions. Planning was internal to the ship and could not be related to the MPP.

MIW integration with NFN context

- It is unknown whether mine contacts were valid physical realities. Reconstruction is required before this initiative can be evaluated.

MIW use of the common undersea picture (CUP) context

- MIW Cup and ASW CUP were independent, so no examination of a common picture can be made.

MIW Experiment Quality Condition

Overall quality of the experiment was **marginal** because of an inability to match needed experiment conditions and execution.

Anti-Submarine Warfare

Because the naval contribution to rapid decisive operations requires assured access, ASW forces are required to establish zones of operations free of enemy submarines. To do this effectively, the forces are forced to employ network-centric ASW operations. This is the concept of multi-level commands and multi-disciplinary forces that are well connected by common communications, doctrine, planning tools and commander's guidance. In order to improve detection, classification, localization, and neutralization of enemy submarines, these commands must possess the ability to:

- Rapidly share information.
- Correlate their situational awareness as it pertains to the larger operational and tactical pictures.
- Conduct distributed, collaborative planning and self-synchronize their actions with other joint or coalition ASW platforms.

The primary issue formed as a question was:

"How can network-centric ASW operations improve detection, classification, localization and neutralization of enemy submarines to assure maritime access?"

Submarine locating devices context

- The ASW commander had no control over the frequency of these reports.

Remote autonomous sensors context

- Virtually all of the RAS initiative C2 procedures and processes were devoted to simulating the autonomous distributed sensor (ADS) fields and autonomous USVs.
- USV technical difficulties precluded successful observations.

Experimental common undersea picture (X-CUP) context

- Parts of the undersea picture resided in several different, un-integrated systems.
- Loss of satellite communications caused the loss of the network.

ASW Experiment Quality Condition

Experiment conditions matched the initiative well. Quality was **good.**

Information Operations

This initiative was to develop specific functional responsibilities for each IO forward billet to ensure maximum enrichments to all dimensions of JFMCC operations. IO rear critical support billets and functions were to be identified. Four IO sub-initiatives were incorporated in the experiment to investigate emerging organizational constructs, processes and capabilities to support JTF and JFMCC processes with a full range of IO options.

IO enrichment to the JFMCC planning process context

- Originally, 28 billets were identified in joint doctrine to populate the IO cell, but the actual manning was a less than adequate 11 people (inclusive of two each, USAF and USA liaison).
- JFMCC maintained tactical control over individual units, effectively eliminating the need for the IWC.
- The MTO was not designed to accept missions without targets, such as typical in IO actions.
- PWCs were removed from consistent JFMCC interaction and they lost touch with all dynamic updates shared through the JFMCC staff and had insufficient oversight of the IO plans being developed.

Collaborative IO planning context

- The JFMCC did not have an information warfare planning capability, which is required for integrating, synchronizing, and optimizing IO weapons with kinetic and non-kinetic maritime operations.
- The presence of readily prepared operational net assessments (ONAs) largely minimized the opportunity to explore the full possibility of timely, extensive IWPC utility and potential.
- IO staff was largely forced to rely on ONA database vice real world information, so targeting did not use IWPC data.
- An insufficient number of workstations forced collaboration to be face-to-face or via telephone rather than via the CIE, restricting data collection opportunities.

Offensive IO context

- IO weapons were not integrated into the simulation (SIM) federation.
- E-strike weapons were not loaded into the theater battle management core system (TBMCS).

Information Operations Experiment Quality Condition

Testing of the concept of including the IO Commander into the planning process was **good.** Testing of defensive IO capabilities was **good** especially for initial methods and a way ahead, overall development was **marginal.** There was no way to test offensive IO results, quality for this aspect was **very low**.

Netted Force

The Netted Force Initiative focused on knowledge processes, use of collaborative tools, and supporting organizational structures. There were three sub-initiatives: knowledge management organization (KMO) (use of KMO to support JFMCC and battle-staff), collaborative information environment (CIE) (technical systems to support rapid decisive operations (RDO)), and ground common operational picture (COP) (links between traditional COP track management, engagement tools, target management, and intelligence order of battle tools). Each of the sub-initiatives was to document or define the KMO contribution to:

- Commander's situational awareness
- Decrease in information overload
- Bandwidth management in support of combat operations

KMO sub-initiative context

- The contribution of KMO to information management was secondary to the technical aspects of information communications. Data capture was at a lower level than originally envisioned.
- Active bandwidth management was not implemented.

Context for CIE sub-initiative

- Shared Point Portal System (SPPS) interface was used for collaboration.
- LAWS/ADOCS were proprietary systems and difficult to integrate with SPPS or JFMCC applications, although some displays were transitioned to other systems.

Netted Force Experiment Quality Condition

The overall quality of the initiative was **marginal**, and the CIE sub-initiative was **good**. Greater specification of roles, objectives, processes, authority, and support will be needed for future experimentation.

Joint Theater Air Missile Defense (JTAMD)

In the future, Navy theater air and missile defense (TAMD) capability will be hosted as one of the multi-functional capabilities onboard surface combatants. Navy planners will be required to balance joint (critical asset defense) and maritime (force protection and access) requirements and effectively and optimally employ limited numbers of ships in a dynamic battlespace environment. FBE Juliet simulated the dynamic interactions necessary to assist in developing a Joint TAMD/AAW TACMEMO.

The overarching questions to be addressed were:

- Can a single commander appointed as the Battle Force Air Defense Commander (ADC or "AW") and a Regional Air Defense Commander (RADC) supported by the AADC module planning capability and process effectively support the air and missile defense requirements of both commanders?
- Does the capability to rapidly wargame alternative courses of action with the embedded wargaming (M&S) capability and provide graphic displays provide value added to the Joint Force Maritime Component Commander (JFMCC) and Joint Forces Air Component Commander (JFACC)?
- What emerges as functional relationships between JTFHQ (and production of the effects tasking order and/or the defended asset list), the JFMCC (maritime tasking order) and JFACC/AADC (air tasking order)?
- What emerges as the organizational relationship between the SJTFHQ theater missile defense (TMD) cell, JFACC/AADC, Deputy Area Air Defense Commander (32nd AAMDC), Regional Air Defense Commanders (RADC) and the maritime Air Defense Commander?
- What elements of the experimental organization, TTP and C2 learned from this event are suitable for inclusion in a future USN AADC module TACMEMO?
- Did the JFMCC maritime planning process mitigate the dilemma posed by competing demands for multi-purpose surface combatants?

Balancing requirements between joint and maritime responsibilities context

- Focus was primarily on joint responsibilities.
- There was little demand for assets to support maritime needs, thus competition was not exercised.

Optimal employment context

- There was little to no competition for multi-mission ship resources so optimization, which would typically occur in times of over-commitment, could not be analyzed.

Single commander context

- The C2 structure was not predefined as part of TTP.
- Role and responsibilities of the RADC were not well documented; complicating plans execution of plans and attainment of experiment goals.
- The RADC/ADC was not integrated into the AOC or battle rhythm.

Demands on multipurpose ship context

- Without multiple, and conflicting, demands for support, it was not possible to analyze and draw conclusions.

Functional and organizational relationships context

- The relationships of the major commanders had to be structured informally and refined during the experiment, because there was no formal joint architecture for C2.
- FBE-J did not stress the relationships with conflicting, time-critical demands on resources; thus, it was not possible to predict the ultimate endurance or success of the informal relationships.

The quality of the TAMD initiative of FBE-J with respect to being able to obtain information that applied directly to stated objectives within the initiative was **marginal.** However, the simulations of FBE-J provided a rich environment for constructing a joint architecture for missile defense, producing a **good** methodology for future experimentation.

3.3 FBE Experimentation Status and Recommendations

General Status

Fleet Battle Experiments are minor miracles in one sense, inappropriate events in another. They are minor miracles by virtue of the fact that such huge, complicated, multi-organization events get planned, executed, and produce results. They are inappropriate in that they are not the best means for obtaining the information desired.

The "good" in FBEs is in their intent-- i.e., to provide a multi-level and dynamic environment for process, practices and technology to work within, and which may be markedly or completely different from current status quo. "Concepts" can be better understood within this framework.

However, the question being asked in this Section is, "Are FBEs properly constructed to deliver their maximum learning potential?" The answer seems to be "no."

Therefore, the following focuses on improvements that need to be made to FBE experimentation— rather than what is right about them. The intent is to provide recommendations that, if incorporated, will yield improved results from future experimentation.

Expectations for Experiment Design

FBEs in general have experienced a mismatch between experiment plan (EXPLAN) expectations with regard to attaining experiment objectives derived from concepts and the realities of experiment design. Assumptions are made in the definition of experiment initiatives that find their way into experiment planning without the benefit of experiment design and practicalities with respect to what is physically possible to be known from the experiment. These mismatches tend to continue as part of the planning process until handed off to data collectors, with an expectation that analysis will produce the intended learning. At the very least, there must be additional and close coupling between definition of the experiment, its design, an analysis method that is attainable, and the data that is required by those methods. Current planning methodology for FBEs does not enhance this coupling.

Process Improvements

A more productive process would be:

- Define the learning objectives.
- Determine the events (workshops, war games, T&E, experiments of all types) necessary to meet those objectives.
- Lay out a study plan in a coherent sequence of events.
- Execute the events needed to build a body of knowledge.
- When sufficient background knowledge is produced, execute an operational experiment, if needed.

The above process recognizes that operational experiments are but one learning tool, rather than an end in themselves, as has been the case to date.

Experimentation in general suffers from lack of internal cohesiveness. In essence, it is not thought of from the perspective of a "systems approach." Incorporating this systems perspective would automatically eliminate many of the emergent contradictions and constraints found in FBEs to date, and includes the analysis of results in a "total systems analysis."

Total-System Analysis

Experimentation needs to concentrate on the total system. There is currently too much emphasis on hardware system performance and not enough on processes within which those systems operate. The "total system" is made up of:

- Hardware components
- Systems of hardware components
- Information structures
- Command structures
- Decision processes
- TTP
- Human machine interactions
- Human factors, including training

In addition there are factors that have to do with the fact that a military operation is being investigated:

- Red and Blue objectives
- Red-Blue physical interactions
- Red-Blue psychological and political interactions

Experiment design needs to consider the "fitness" of all of these factors with learning objectives and the analyses by which results may be determined.

The idea of "fitness" between concept, objective, execution, and evaluation (all within a total-system perspective) has additional pieces, such as the role of high-level concepts (e.g., network-centric warfare), simulation, systems architecture, and various relations with data collection and analysis.

Net-Centric Warfare/Information Management

Net-centric warfare contains several basic concepts, three of which are especially pertinent to work that has been done in FBEs.

- All pertinent battlefield information can reside in a common system (COP).
- This information can be made available to all participants in an operation.
- Decision quality will be improved by having this information available.

Realizing these concepts requires a different approach to data, information, and knowledge accession, maintenance, and distribution, yet the systems and processes in Juliet and other FBEs tend to be straightforward extensions of the past.

FBE-J results demonstrate that more attention is needed toward providing information that is relevant to a particular task and on designing new decision processes that recognize the new information environment. A significant shift from systems to processes is needed.

Transformations of concepts that are occurring:

- From a common "picture," to a common database from which information is drawn.
- From "common" information, to information that is relevant to performing a task.
- From common displays, to presenting information in a way that is task pertinent.
- From fitting information to processes, to redesigning processes around information.

Achieving this transformation requires intelligent agents to fuse and sort information. It also requires developing processes that fit the new information environment, which can probably only be done by sophisticated process modeling. FBE examination of net-centric concepts needs to move in these directions.

Simulation

Simulation is used to provide event stimulation of FBEs. This is required for a variety of good reasons. The underlying physics for events reside in the simulation. From a total system understanding point of view, one cannot adequately analyze experiment events without having a complete understanding of what is occurring in the simulation. However, this level of understanding is not available to those analyzing FBEs. There are two issues:

- Reconstruction of events is an analysis imperative that requires simulation and live action data. Experiment objectives should define the kinds of reconstruction required, and must be engineered prior to the experiment. Data extraction from simulation (e.g., joint semi-automated forces (JSAF) or the high level architecture of which it may be part) must be built in as part of the simulation system requirements.
- Understanding events requires knowing their underlying physics, in this case the physics modeled into the simulation. For example, is weapon-target interaction based on an extended range guided munitions (ERGM) or a Tomahawk; does a sensor's probability of detection depend on foliage; etc.? The needed level of understanding within the simulation is not available to analysts.

System Architecture

There is a tendency to bring systems into an FBE with an incomplete overall architecture design. One of the minor miracles is that the systems perform as well as they do. However, inconsistencies do emerge during an experiment and they can obscure the information one is trying to gather. FBEs need a master architect, who has appropriate authority, and focuses not only on whether systems will work together but also on whether the resulting configuration and use will meet experiment objectives.

Data Capture

Each FBE initiative requires significant amounts of data and information in order to perform adequate analyses. As experiments have moved toward more rapid uses of information, it has become increasingly necessary to acquire data electronically in order to track processes. It has been difficult to acquire all needed data. This applies to both simulation data (stated above), and transaction data (e.g., the electronic data from systems such as the Land Attack Warfare System (LAWS)). FBE priorities need to place capturing adequate electronic data near the top.

Data collection should be as automated as possible. All data should be regularly transported to a central site and copied to another site so that there is some measure of insurance against loss. Problems exist with having data stored on PCs that were then shipped to various organizations across the country, necessitating a special effort to re-acquire the data, always with the potential that this effort may not be successful.

Besides the "fitness" described above, there are engineering standards and best practices that should be followed, such as pre-experiment testing. Although the spiral structure of FBE Juliet provided some opportunity to perform testing, it could not make up the entire differential between immature systems and experiment execution. At best, the final spiral event pre-FBE Juliet was an opportunity to wring out possible threads that might be activated in execution. This was not the correct forum to engineer systems into proper performance. Those activities should have been accomplished in the process leading each system towards successful performance in the FBE.

Process and Decision Structure Testing

In keeping with the net-centric approach, much FBE effort has been expended on use of information for rapid decision-making, with Fires as a major thrust. Adequate testing should include stressing the process. To date, FBEs have dealt with environments that are not target rich or do not have large numbers of targets to deal with in a short time. Thus, it is not known what performance parameters will be under those circumstances, which are critical in actual combat.

Engineering Support

Complete planning, engineering, and testing of systems needs to be done before trying to demonstrate possible functionality in an FBE. Several FBE-J initiatives relied on or evaluated equipment that failed. Examples include the micro-netted unattended ground sensors (MIUGS), ASW remote autonomous sensors (RAS), and knowledge kinetics (K2), a work-flow software program that at the technical level was successful, but was not integrated in processes to actually do the job it was intended to do. Because many initiatives are predicated on the successful operation of equipment or sensor suites, or integration of new software (as in the case of K2) new equipment should be given sensibly exhaustive checkouts beforehand so there will be reasonable certainty that it will work as advertised when it is expected to be operating during the experiment.

It has been argued (incorrectly) that while systems, technology, processes or software may not perform; the experiment concept is not at risk. In other words, the thought is expressed that there is autonomy between concept and the means to learn more about that concept in an experiment. This is a faulty notion. While it may in fact be true that the piece of hardware or software, or perhaps even system is not the point of the experiment, furthering the concept (which is the point) cannot be accomplished in the face of inadequate performance of supporting equipment.

ISRM MIUGS and the ASW RAS are examples that warrant description to better illustrate this point. As yet there is no agreement on MIUGS performance emerging from the experiment. Characterizing this performance is a necessary component to modeling and supporting the larger concept of which this is a part. A thorough check of sensor performance and communication links beforehand would have eliminated problems and enhanced what was learned. For the ASW system, robo-skis were understood to be a difficult platform on which to place very sensitive sensors, which were designed for stationary employment. In another ASW example, modifications to DICASS buoys for use with helicopters moved the power source too far from the transducer for adequate performance. Thus, neither experiment could be said to adequately support the concept of autonomous sensor employment, nor was parameterization for further experimentation obtained. All three systems could have been matured and tested prior to STARTEX in order to achieve a higher order of success. In addition, fielding the deficient systems during an FBE did not provide good data on how to improve the systems, thus representing a waste of effort and resources.

There are other factors in the complex interrelations of these experiments that are not adequately addressed, but would contribute to overall context and performance. An example is the role of logistics.

Logistics Metrics

FBEs are not realistic in terms of logistics or assets use, which leads to artificial/unrealistic results. Simulation provides most of the event stimulation necessary to engage experiment systems and processes. However, there is very little feedback that incorporates use of metrics to account for logistics and expenditures, i.e., how long resupply would take, how many missiles are available in a particular ship. In addition to the tracking of expenditures, the quality of those expenditures is not considered. For example, Harpoon missiles were used to destroy motor whaleboats – a tremendous asymmetry in values and a potential future opportunity cost, thus an unrealistic action in the real world.

Post-Experiment Requirements

Past FBE analyses have suffered from a lack of continuing participation by the initiative leads, concept definers, principal participants, observers, and analysts. To date, the only group engaged in all three phases of experimentation (planning, execution, analysis and reporting) is the data collection and analysis group, which has not included leads from planning. Post-experiment dialogue should include the entire group to determine what events took place, produce a narrative of the interactions, come to consensus on context that impacted results, and determine what is necessary for final reconstruction, analysis, and reporting. Quicklook reporting does not provide the necessary forum for this dialogue and provides neither cause and effect analyses nor quantitative conclusions.

It is highly recommended that <u>all principal participants in each of the initiatives be retained for all three phases of the experiment</u>, not just the first two.

Scope of Complex Experimentation

It is likely that the Navy would find value in narrowing the focus of the complex experiments, which will also include “not to interfere” demonstrations. Rather than try to do many things, at great expense and with insufficient designers, observers, or analysts, it would be better to focus on only a few initiatives and do them very well. There must be assurance that this limited number of objectives are all well designed (with overall priorities and the ultimate analysis in mind), thoroughly observed and documented, and comprehensively analyzed. Additionally, each formal Fleet Battle Experiment should be part of a continuing mosaic, designed to build mounting improvement in capability beginning with the highest priority processes over a number of years.

Section III: Reconstruction

4.0 Experiment Reconstruction

4.1 Scenario and Timeline

- The year 2007.
- Country Red sits astride a strategic waterway important to the world's economy.
- A faction inside of Country Red has seized islands in the waterway that belong to a neighboring nation and has interrupted the shipment of oil.
- This interruption of international shipping has exacerbated existing world economic problems.
- Country Red has weapons of mass effectiveness (WME) that it is using to threaten surrounding countries to prevent them from supporting any international efforts to reopen the waterway.

Figure 4-1. FBE-J Locations and Settings.

4.2 Actual Setting

- Southwest US DoD training and weapons ranges represent Country Red.
- Portions of the Southern California Navy operating area represent the critical waterway.
- San Clemente Island, San Nicholas Island, Santa Barbara Island, and Santa Catalina Island represent islands seized by Country Red in the critical waterway.

4.3 Joint Forces: Live and Computer Simulated Forces

- Navy: two Carrier Battle Groups and two Amphibious Ready Groups.
- USMC: Marine Expeditionary Brigade.
- Army: Airborne and Medium Brigades.
- Air Force: Aerospace Expeditionary Force.
- Joint Special Operations Task Force.

Live Forces / Ranges

Joint Force HQs
- XVIII ABN CP HQ

Army
- ARFOR/DIV HQ
- 1 x ABN BDE HQ
- 1 x ABN BN TF
- 1 x IBCT BDE TOC (& CSS PKG)
- 1 x IBCT IN BN TOC
- 1 x IBCT RSTA SQN TOC
- 1 x MEP (2-3 PATRIOTS)
- 32nd AAMDC (-) TOC/ABMOC
- 1st BCD
- JICC-D
- DEEP ATTACK PKG (AH, HIMAR & C2)

STRATCOM
TPRC

Navy
- JFMCC and CWC Staffs
- 1 x LCC (C2-CORONADO)
- 1 x LHD
- 2 x AEGIS (DDG)
- 2 x SSN
- 2 x HSV (Joint Venture & Sea Slice)
- 4 x AHCM (H-53)
- 8 x F-18
- 1 x E-2C Hawkeye
- 1 x EA-6B Prowler
- 2 x P-3C Orion
- 2 x SH-60B Seahawk
- 2 x MK V

Marines
- JFLCC (T)
- MEB (C2 ELE)
- GND CBT ELE (BN (+))
- AVN CBT ELE
- CBT SVC SPT ELE

Air Force
- JFACC
- 8 x A10/OA 10
- 2 x B1
- 2 x B2
- 1x B52
- 2 x E3 AWACS
- 1 x E8 Joint STARS
- 10 x F15E Strike Eagle
- 6 x F15C
- 8 x F16
- 10 x F16CJ
- 1 x F117
- 1 x HH60
- 6 x KC135
- 1 x RC135 RJ
- 1 x U2
- 2 x Predator UAV
- 1 x Global Hawk UAV

Special Operations
- JSOTF, JSOGC, JSOMC, JSOAC HQ
- JSOGC SF BN (-), NSWTG, SOS (-)
- 528 SOSB, 112 SIG BN
- JPOTF RESPONSE CELL
- JSOC RESPONSE CELL

SPACECOM
- JOINT SPACE SPPT TEAM
- SPACE, JIOC, JTF-CNO

Ranges

Army
- (Ft. Irwin)

Navy
- NTC Pt Mugu
- China Lake

Air Force W. Islands
- NTTR W. Ranges (Nellis, AFB)

Marines
- Camp Pendleton
- SCLA (George, AFB)

Figure 4-2. Live Forces and Ranges.

4.3 Operations Overview

The overall Blue Mission was to conduct Rapid Decisive Operations to assure access through the strategic international waterway. The operations can be summarized as follows:

- A pre-hostilities situation existed through 27 July, during which both Red and Blue were positioning forces.

- On 27 July, Red initiated hostilities by attacking the Abraham Lincoln Battle Group and the Tarawa Amphibious Ready Group.

- From 27 through 29 July, the main effort was engagement of Red maritime forces and air strikes against critical Red C2 targets and TSTs.

- On the 30 July, the Joint Force executed a planned land assault on Red WME sites, including ship-to-objective-maneuver (STOM).

- Starting 2 August, the main effort shifted back to Maritime Access operations to support civilian tanker traffic through the straits to restore the flow of oil.

- The Fleet Battle Experiment concluded on 5 August 2002.

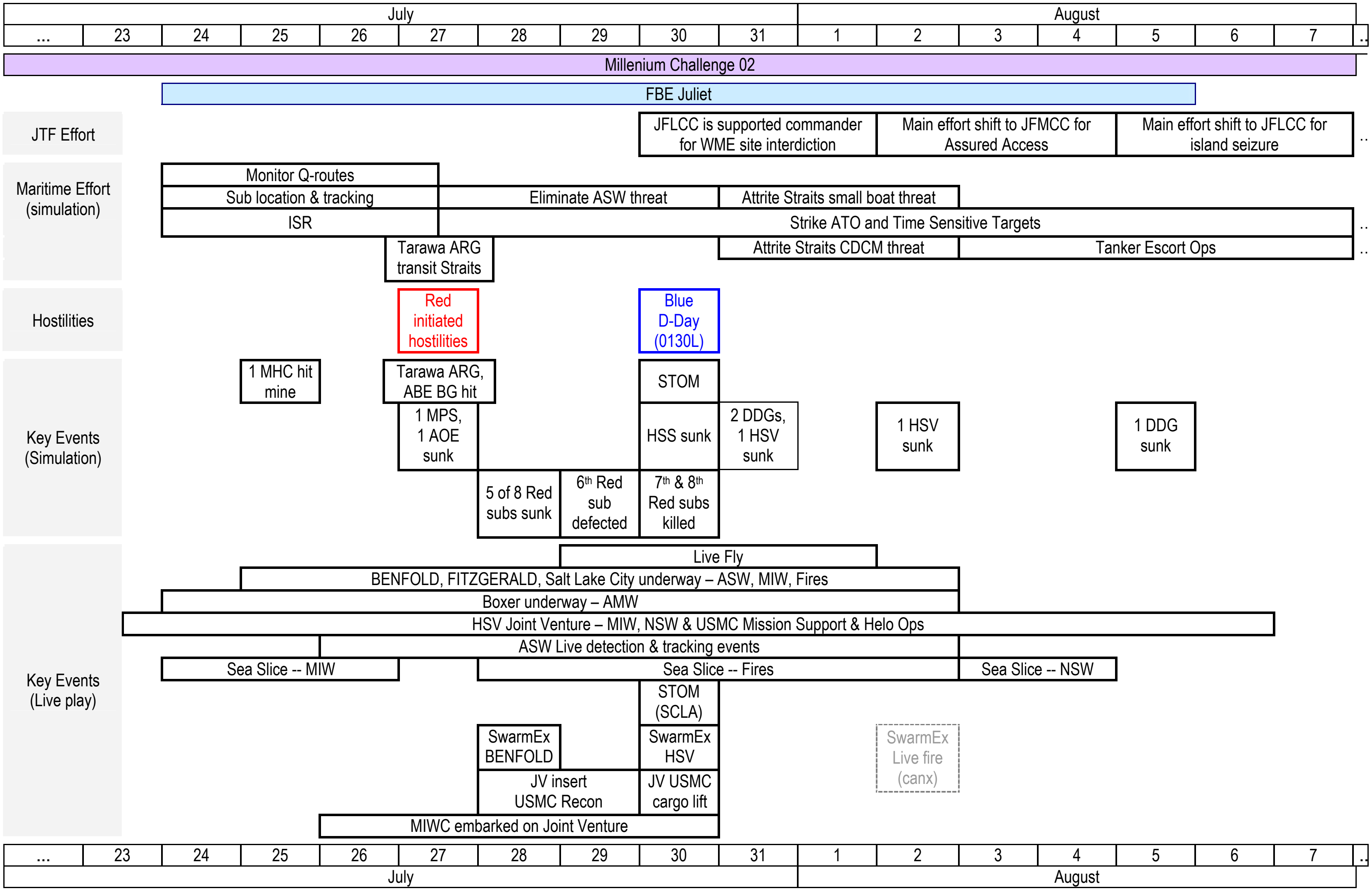

Figure 4-3. FBE-J Timeline

Section IV: Key Observations

5.0 JFMCC Maritime Planning Process (MPP) Initiative Key Observations

In future maritime operations multi-functional maritime platforms are envisioned, with multiple weapons systems, sensors, organic capabilities, highly sophisticated C2, and minimum manning. Providing access to the littorals will be a requirement for maritime forces, often ahead of scheduled flows for joint capabilities. A maritime tasking order will be required to optimize, synchronize, and interweave maritime and joint forces.

Structures and processes exist to produce plans for using maritime forces in response to Commander's Guidance. The increased pace of operations and increasing coordination needed between service components for joint operations have resulted in needed changes. The Joint Forces Maritime Component Commander (JFMCC) Maritime Planning Process (MPP) Initiative was a proposed system of processes for deliberate planning and command and control (C2) to be employed by the JFMCC. In FBE-J, this initiative provided the first in-depth, critical examination of JFMCC and the MPP in a joint, operational environment.

The JFMCC MPP is a collection of interactions between many processes with feedback required between them (e.g., effects assessments resulting from actions). In discussing the MPP, as noted above, it should be thought of as a system, vice process. Among other actions, the MPP interprets guidance from the Joint Force Commander (JFC); produces a joint maritime operations directive (MOD); defines maritime support requests (MARSUPREQ's); prioritizes actions in a master maritime attack plan (MMAP); and assigns action to individual maritime commanders in a maritime tasking order (MTO).

Because JFMCC and MPP are recent concepts, desired results were at a basic level:

- Did JFMCC and MPP work in Juliet?
- Can they work or are there fundamental flaws?
- What is needed for them to work sufficiently?
- Was Juliet structured correctly to answer these questions?
- Develop a set of recommendations for future JFMCC learning objectives.

The fundamental, overarching concern to be addressed by this initiative is flow of information and work. (A "process" is defined as an element of organization that does "work" to information, passing the result to other processes or to storage for later use). MPP is a linear, segmented process, with seven basic steps (outlined in section 5.3 below) for the production and execution of the MTO. This is essentially a complex workflow, analogous to an assembly-line type process. As an example of one assembly node: within the current planning cell, individuals acting as subject matter experts (SMEs) represent the needs of their Principal Warfare Commander (PWC), and do specific jobs in the production of the MTO. They need a variety of information, such as available assets, guidance from their PWC and the effects tasking order (ETO), etc., in order to produce their contribution to the MTO. Within a 72-hour period, there can be as many as 3 MTOs in various stages of production at the same time.

The MPP is designed to coordinate activities of all principle warfare areas and support the production of effects desired by JFC and JFMCC. A "campaign" is developed to meet JFC objectives with each MTO meant to optimize combined effects from each warfare area rather than sub-optimizing individual areas. Each PWC must contribute assets in a coordinated and coherent plan in order to perform optimized, maneuver operations. This implies a great deal of coordination between the SMEs, and between SMEs and their PWCs, during planning. Such coordination is complex, and it is theorized that different "battle rhythms" associated with each warfare area contributes to this system's complexity. Thus, shared asset utilization may not be constant through a full MTO execution cycle.

Information and work within this assembly line (actually three parallel lines) must be highly synchronized. Sufficient coordination must be enabled between various Commands so that individual and collective goals can be adjusted in a timely manner in order to produce an optimized plan. Thus, the following basic MPP components examined in this initiative are:

- Coordination of asset utilization between Maritime or Joint commands
    - Some, but there is little evidence of this in data.

- Coordination/adjustment of daily goals between commands
    - From CINC to CJTF to JFMCC, principle coordination was by numerous briefings.

- Synchronization of information and work
    - Info Work Space (IWS) and SharePoint Portal System (SPPS) provided virtual briefing space chat rooms and alternate virtual conference rooms for information sharing, synchronization of effort, and work.

- Information feedback, primarily BDA
    - Data do not reveal a high degree of coupling between the results of missions and the MPP. Participant data and comments establish feedback as a critical area for improvement. (As an experiment design note, the lack of feedback may or may not represent the same paucity of information from actual combat. However, the point of this analysis is that at the system level, feedback was largely not available as the enabler required to make the experimental MPP system perform adequately, or the process to use information in feedback was not part of the organizational construct. More is said on this topic later in this report).

- Manpower requirements to maintain three MTO assembly lines
    - Heavy operational tasking is placed on available personnel. It is very likely that the experimental organization would not be capable of performing 24-hour operations over an extended time. Also, the number of maritime support requests, approximately 3,000 over a 10-day period, would not be adequately serviced. It is not possible, in these data, to separate, as independent variables, organization, technologies present, and those technical capabilities that were assumed.

To properly understand the JFMCC MPP a process model to visualize complex relationships is required. One of the goa